ACCLIMATIZATION AND VENTILATION STUDIES OF CATTLE

With special reference to the histology of cow skin, the main organ of heat dissipation.

A Thesis submitted to the University of Edinburgh for the degree of Doctor of Philosophy in the Faculty of Science.

by

Shih-Hsing Yang

May, 1948

The Hannah Dairy Research Institute,
Kirkhill, Ayr, Scotland.

ACKNOWLEDGMENT

The author wishes to express his gratitude to the Council of the Hannah Dairy Research Institute for the facilities accorded to him at the Institute. He also wishes to thank Dr. N.C. Wright, Professor S.J. Watson and Dr. J.A.B. Smith for their helpful advice and encouragement. He is particularly indebted to Dr. J.D. Findlay for his invaluable guidance and cooperation.

The cow-hides were kindly obtained by Dr. P.S. Watts, and many valuable suggestions regarding the statistics were given by Dr. D.N. Lawley.

Most helpful technical assistance was given by Miss M.R. Currie and Miss E.E. Wood. Other members of the staff of the Institute also helped. The author wishes to express his sincere thanks to them all.

VOLUME ONE

CONTENTS

VOLUME TWO

CHAPTER I

INTRODUCTION

The maintenance of an even body temperature in the optimum range for biological activity is the characteristic of homeothermic animals and requires a proper balance of the two fundamental processes of heat production and heat dissipation. Thus, in a hot environment, homeothermic animals have to reduce their heat production and increase their heat dissipation in order to eliminate excessive heat, and if the animal is in a cold environment, these changes must be reversed. This balance of heat production and heat dissipation calls for the cooperative and coordinated activities of the various vital systems of the animal; the circulatory, respiratory, endocrine, and nervous systems, the skin and its appendages. Hence, the acclimatization of cattle of the temperate regions to the tropics involves an enormous adjustment on the part of the exotic animals, whose physiology is suitable for a temperate climate, but not for the tropics.

The problem of the acclimatization and adaptability of European cattle to the tropics compared with that of the indigenous animals and with that of the cross-breds has been studied by various workers. Rhoad (1944) working in Louisiana found that the body temperature of cattle increased with increasing environmental temperature, and also that the indigenous cattle showed less of an increase in body temperature with increasing environmental temperature than did the

exotic European breeds. As a result of these and other experiments, he devised the Iberia Heat Tolerance Test, in which the change of body temperature of cattle subjected to an arbitrarily chosen tropical climate is measured. By means of the following equation, he was able to compute the heat-tolerance coefficients of the different breeds of cattle :-

$$H = 100 - 10 \ (BT - 101.0^{\circ})$$

where H = heat tolerance coefficient, BT = body temperature of cattle in degrees Fahrenheit, 101.0° = normal body temperature of cattle in degrees Fahrenheit, 10 = a factor to convert degrees deviation in body temperature from the normal to a unit basis and 100 = perfect efficiency in maintaining body temperature at $101.0^{\circ}F$.

The heat tolerance coefficients of the local Zebu, and Aberdeen Angus, were calculated by this equation to be 89 and 59 respectively, while those of the Jersey, Hereford and various crosses between the exotic and indigenous breeds were found to be intermediate. Seath and Miller (1947) compared the heat tolerance of Jersey cattle with that of Holsteins and found the former to be better in this respect than the latter. Seath and Miller (1946) in Louisiana analysed the relative importance of high environmental temperature and high relative humidity as factors influencing the body temperature, the respiration rate and the pulse rate of cattle and found that the environmental temperature was the more important. Gaalaas (1945) used Jerseys to study the effect of atmospheric temperature

on the body temperature and respiration rate, and found the coefficients of correlation to be 0.57 ± 0.079 and 0.77 ± 0.0046 respectively. Later, in (1947) he investigated the heat tolerance of the Jersey cattle and concluded that a definite difference in heat tolerance existed in the different age groups and that little change in the heat tolerance occurred in the same herd from year to year. Bonsma, Scholtz and Badenhorst (1940) working in South Africa claimed that the Aberdeen-Angus lost control of its body temperature with the rise of environmental temperature earlier than the Hereford. All these experiments were performed under field conditions.

Freeborn, Stanley, Regan and Berry (1934) studied the body temperature of Jersey and Holstein cattle in a psychrometric room, the temperature and humidity of w hich could be controlled at constant levels. They showed that the Holsteins lost control of their body temperature at a lower temperature than the Jerseys. These findings agreedwith the results of the field experiments of Seath and Miller (1946). Regan and Richardson (1938) tried the same experiments in the psychrometric chamber and found that when the environmental temperature rose from 40° to 80°F., there was almost no change in the body temperature of the animal, but that above 80°F., the animals lost control of their body temperature, which rose to as much as 105.1°F., when the air temperature was 100°F. However, as shown by Winslow, Herrington and Gagge (1941) for

man, the balancing of heat production and heat dissipation may not be a simple process. According to these authors, the thermal exchanges of man with his thermal environments may be expressed by the following equation :-

$$M - E \pm C \pm R = S$$

where M = heat produced by metabolism, E = heat lost by evaporation, C = heat lost by convection to the ambient air, if that air is below the temperature of the skin, or gained if that air is above the temperature of the skin, R = heat lost by radiation to the surrounding surfaces if those surfaces are below the temperature of the skin, or gained from those surfaces if they are above skin temperature and S = the storage, which is the net arithmetic difference between the four processes just mentioned. When the heat produced by metabolism is not exactly balanced by the algebraic sum of evaporative, convective and radiative heat loss the actual temperature of the body may be altered as a result of heat storage. When the environmental temperature is high, rectal temperature in general varies directly with changes in the storage value. If the cooling effect of the environment is great, the rectal temperature no longer reflects storage correctly, because the peripheral areas of the body cool off more rapidly than the rest.

In order to understand why some exotic breeds of cattle lose their control of body temperature more easily than the indigenous breeds under tropical

conditions, it is essential to compare their heat production and their heat elimination by convection, radiation and evaporation. Should there be any difference, it is necessary to establish whether it is due to the difference in metabolic rate, to the difference of the thermal conductivity of their skin, or to the difference in the perspiration rate. Unless this is understood, it is impossible to state the physiological difference which make temperate cattle incapable of withstanding tropical climates. The emphasis in the present study is on the skin as an organ for heat dissipation through convection, radiation and evaporation. No attempt has been made to deal with the problem of the heat production of cattle under high temperatures, or with heat elimination by the respiratory system, nor does the work touch on the subject of the coat and hairs of cattle, though differences in coat and colour definitely influence the absorption of radiation (Bonsma and Pretorius, 1943; Riemerschmidt, 1943; Riemerschmidt and Elder, 1944).

Winslow, Herrington and Gagge (1937) have shown that convective heat loss by man may be calculated from the following equation :-

$$C = k_c \sqrt{V} (T_s - T_a)$$

where C = convective loss depending on the physical processes involved and on the shape and posture of the individual, V = velocity of air in feet per minute, T_s = mean temperature of body surface in ^{o}C, and T_a = ambient air temperature in ^{o}C.

The same authors have shown that the radiative heat loss by man may be calculated from the Stefan-Boltman equation as follows :-

$$R = A_r \, k_r \, (T_s^4 - T_w^4)$$

where R = radiative heat loss in kilogram-calories per hour, A_r = effective radiation surface of the body in square meters, k_r = the Universal Radiation Constant, T_s = mean temperature of body surface in Absolute degrees, and T_w = mean temperature of the surrounding wall temperatures.

In these two equations, the skin temperature is important. In convection the heat loss varies with the difference between the skin temperature and the air temperature, while in radiation the heat loss varies with the difference between the fourth power of the skin temperature and that of the temperature of the surrounding surfaces. The larger the difference between the skin temperature and the environmental temperature (both air temperature and wall temperature), the more heat is lost by radiation and convection.

With man at 23°C the heat lost by radiation and convection represents about 80% of the total heat loss (Hardy and Du Bois, 1938). As the environmental temperature rises to 35°C, the difference between the skin and environmental temperature is decreased and heat loss through convection and radiation is reduced to only 10% of the total heat loss, while the main burden of heat elimination is shifted to the evaporative process.

The skin temperature is subjected to the influence of a number of factors. Quinlan and Riemerschmidt (1941) measured the skin temperature of the shorn flank region of a Sussex bull under various environmental conditions. They found it to be 98.6°F. in the sun and 96.7°F. in the shade. The influence of air temperature on the skin temperature has been demonstrated by the same authors, who showed that an increase of 1°F. in the air temperature results in an increase in skin temperature of 0.28°F. in the sun and 0.31°F. in the shade. The body temperature is also an important factor. An increase of 1°F. will cause a rise of the skin temperature of 2.0°F. in the sun and 2.6°F. in the shade. The plane of nutrition also exerts some influence upon the skin temperature. Thus Benedict and Ritzman (1923) showed that when three groups of cattle each fed at a different nutritional level were kept in the same environmental temperature (57.2°F. to 64.4°F.), the skin temperatures of the fasting group was 81.5°F as compared with 89.6°F for the group on a sub-maintenance ration and 91.4°F for a group on full maintenance ration. However, in a later paper Ritzman and Benedict (1927) cast doubt on these earlier findings.

Winslow, Herrington and Gagge (1937) have shown that the rate of blood flow is another important factor affecting skin temperature. Since the blood temperature is the same as the internal body temperature, the more blood flows to the skin, the higher the skin temperature

will be and the more heat will be eliminated by convection and radiation to the colder environment, The more blood that flows to the skin the higher will be the skin temperature. It follows, therefore, that the more blood vessels or capillaries a unit area of skin possesses, the more blood can be brought to the skin surface and the more effective will be the heat elimination through convection and radiation.

Krögh (1929) stated that there were two different mechanisms controlling circulation in the skin. He claimed that the dilatation of arteries and arterioles was brought about by an increase of the body temperature while the dilatation of capillaries was caused mainly by the rise of local temperature. With cattle subjected to high tropical temperatures both the body temperature and the skin temperature are increased. It may be expected therefore that both vaso-dilatation mechanisms are brought into action. However, when the environmental temperature approximates to the body temperature of the cattle, the heat loss by convection and radiation will be reduced to a minimum and the only effective means of heat elimination will be evaporation. In humans the sweat glands play a major role under this condition by supplying water to the skin surface for evaporation. Whether cattle possess any functional sweat glands like those of man is a matter of doubt. Gurlt (1835) first described the sweat glands of

cattle as small oval sacs, differing from the spiral tubules of human sweat glands. He also claimed that cattle sweated most in the inner surface of the ear, in the lateral surface of the neck and in the hind flank. Moreover, he concluded that the sweat glands of all mammals with thick hairs including cattle, originated exclusively from individual hair anlages. This was confirmed by Marks (1895), Diem (1907) and Wimpheimer (1907). Muto (1926) claimed that the sweat glands of cattle were of the bag type. Yamane and Ono (1936) studied the sweat glands of one or two Buffalloes, Holländer, Zebu and Formosan cattle. Using the number of hairs as an index of the number of sweat glands, they claimed that the number of sweat glands varied with the age and sex of the cattle. They also claimed that the secretion of the sweat glands of the buffalloes was of the apocrine type, while that of the sweat glands of other breeds of cattle was of the eccrine type. With only evidence of this sort to go by they stated that zebu cattle withstood tropical climates better than other breeds of cattle because of their greater number of sweat glands.

In the same way they attributed the water-bathing habit of water-buffalloes to the poor development and scarcity of their sweat glands. These views advanced by Yamane and Ono must await further evidence regarding the sweating capability of cattle. Dempsey (1946) described the

arrector pili muscle which crosses the sweat gland ducts, and suggested that the contraction of the muscles in cold conditions would check the flow of the sweat gland secretion and thus form a heat conservation mechanism. This suggestion also was based on the assumption that the sweat glands of cattle do in fact possess a real sweating function but this has not yet been proved.

Brody (1945) compared the evaporative heat losses of cattle and man under different environmental temperatures, and when evaporative loss was plotted against environmental temperature a sharp break in the curve for man occurred at about 84°F. This was stated by Kuno (1934) to be the critical sweating temperature of man. Up to this temperature, vaporization increases irregularly and can account for 35% of the total heat dissipated, but above 84°F. a rapid and steady rise occurs coincident with the outbreak of true sweating, which is responsible for the elimination of almost all the heat lost when the environmental temperature rises to 99°F. With cattle there is no such sharp break at 84°F. or at any other temperature. This difference according to Brody (1945) might reflect some fundamental difference in the sweating capabilities of cattle and man.

Freeborn, Regan and Berry (1943) subjected Jersey cows to environmental temperatures of 85°F. and 115°F. at 60% relative humidity and tested the washings from the coats for the presence of chloride. No chloride was detected, so that either cattle do not sweat or their sweat is not of the chloride type. In spite of all the physiological experiments which have been made the matter still awaits elucidation.

Another important process which supplies water to the skin surface for evaporation is insensible perspiration, i.e. the transpiration of water from the blood capillaries in the skin through the epidermis by osmosis. Hence the high vascularity of the skin not only helps to eliminate more heat through convection and radiation but also supplies more water for heat dissipation via insensible perspiration. With man at 84°F. the insensible perspiration is responsible for about 35% of the total heat loss. Below that temperature the linear rise of the vaporization on an arithlog grid is at the differential rate of 15 to 19% for a rise of 18°F. in air temperature. Hence at an air temperature of 102°F. the vaporization due to insensible perspiration might amount to as much as 50% of the normal total heat loss. In fact if the environmental temperature rises above the normal body temperature, convection and radiation will supply heat to the body rather than cause a heat loss. This will throw a heavier burden on the mechanism for heat

elimination by evaporation. It has been found with man at 104°F. that the amount of heat dissipated by evaporation can be as much as twice that of the total heat produced in the body, the extra heat being absorbed from the warmer environment. The water for evaporation is of course supplied chiefly by the sweat glands. The insensible perspiration is responsible for about one quarter of the total water evaporation.

The part played by insensible perspiration in the temperature-regulation process of cattle has been shown by Freeborn, Regan and Berry (1934) who found that the normal loss of water over the entire body surface of cattle at 84°F. and 60% relative humidity was just over 400 g. per hour. This quantity of water would account for a heat loss of over 5,000 Cal. per day. By assuming the total heat loss of the type of cow used in these experiments to be roughly 18,000 Cal. per day, it will be seen that at 84°F. and 60% relative humidity, about 32% of the total heat loss of the cattle would be due to vaporization from the skin. This figure is very close to that for the insensible perspiration of man at the same temperature. Since as shown by Brody (1945), there is no sign of a sharp increase of water vaporization from the skin of cattle at 84°F., the critical sweating threshold of man, it may be assumed that the so-called 'sweat' glands of cattle do not have an activity like that of human sweat glands at that temperature and consequently the water vaporized from the skin of cattle under these environmental conditions is chiefly that of insensible perspiration.

By spraying cattle with oil Freeborn, Regan and Berry (1934) found that the normal loss of water over the entire body surface at 84°F and 60% relative humidity fell from over 400 g. to just over 200 g. per hour. The body temperature of a Jersey cow subjected to this treatment was raised from 101.5°F to 102.8°F at an environmental temperature of 80°F. This may be explained by the equation of Winslow, Herrington and Gagge (1941) for the thermal exchanges of man with his environment, already referred to on p. 4.
When the factors M, C and R in the equation remain constant, a decrease in the heat lost by evaporation, E, will increase the storage of heat and will result in a rise in body temperature.

Since heat is eliminated by cattle by convection, radiation and evaporation, and since the skin of cattle provides the largest surface for such processes, the skin must be the main organ of heat dissipation. In the present work the anatomical characteristics of the skin of cattle have been investigated with special reference to their function of eliminating heat by these three processes. The main characteristics which have been studied are as follows :-

1. The 'sweat' glands in the different body regions of cattle, their distribution, their secreting surface in relation to a unit area

of skin surface and their mode of secretion.

2. The general distribution of capillaries in the skin of cattle, and the capillary surface per unit area of skin surface.

3. The thickness of skin in the different body regions.

The data thus obtained form a physical and anatomical basis for the study of the rate of perspiration, the rate of insensible perspiration, the thermal conductivity of skin and the heat loss through radiation and convection. By extending these investigations to different breeds of cattle (including exotic European breeds and indigenous breeds of the tropics), a better understanding should be obtained of problems related to acclimatization of cattle.

CHAPTER II

MATERIALS AND METHODS

Five 3 to 4 year old cows, one 9-year old cow and one 8-day old calf were used in the present study in addition to two cattle embryos. They were all of the Ayrshire breed. A piece of skin from the hind flank region of a 5 month-old calf was also used for sectioning. Plate 26 is taken from one of these sections. The ages of the animals are shown below :-

Cow No.	Age in years	
I	9	) Known from the
II	$3\frac{3}{4}$	) records which were available.
III	$3\frac{1}{2}$	)
IV	4	) Estimated from
V	4	) the state of
VI	$3\frac{1}{2}$	) dentition.
Calf	8-days	

The following 21 regions were chosen for sectioning :-

Region	Code letters	Region	Code letters
Forehead	FH	Front flank	FF
Cheek	CH	Hind flank	HF
Neck (dorsal)	ND	Breast	BR
" (lateral)	NL	Abdomen	AB
" (ventral)	NV	Udder	UD
Back (thoracic)	BT	Axilla	AX
" (lumbar)	BL	Groin	GR
" (sacral)	BS	Upper foreleg	UF
Shoulder	SH	Lower "	LF
Gluteus	GL	Upper hindleg	UH
		Lower "	LH

The positions of the regions are shown more precisely in Figure 1 (Vol.II).

The details of the methods used in preparing the vertical and horizontal sections of cow skin in series are as follows :-

The skins of all the cows and the calf were taken to the laboratory almost immediately after the carcases had been skinned. The whole skin of the cow was spread on the ground and the hairs of those regions from which specimens were to be taken were dried by wiping them with dry cotton wool and by gently warming them with a hot-air blower. Care was taken not to overheat the skin. The hairs of the chosen regions were clipped with coarse clippers and then with a fine clipper to free the skin surface from long and coarse hairs. Care was taken not to scratch the skin during the clipping.

A piece of skin about 10 sq. cm. in area was cut from each of the chosen regions, labelled, and fixed in Bouin's fluid for 24 hours. The large pieces of skin were then cut to about 1 sq. cm. and put in Bouin's fluid for another 24 hours. During the cutting, the direction of the hairs was noted. A cutting mark was made to differentiate the head from the tail of the skin specimen so that the long axis of the piece was approximately perpendicular to the hair direction. This served to orientate the block during cutting.

With embryos, the skin was cut from the chosen region, and was gently flattened by pinning it on a small piece of wood and the whole immersed in Bouin's fluid for one hour. It was then removed from the wood support and left in fixative for 23 hours. After fixation, the specimen was washed in 70% alcohol, dehydrated in graded alcohol, cleared in xylol and embedded in paraffin according to the usual histological routine. The paraffin blocks were then sectioned with a rotary microtome at a thickness of 10 microns. The sections were stained with Delafield heamatoxylin and counterstained with eosin.

The hardness and toughness of the cow and calf skins made it difficult for paraffin to penetrate them and made them difficult to section. Yamane and Ono (1936) used the celloidin method, but this is too

laborious and time-consuming for large numbers of serial sections such as were required in this study. New techniques other than the celloidin method had therefore to be developed. The following procedure was used with reasonable success.

> After fixing the specimens for 48 hours in Bouin's fluid, they were washed in 70% alcohol until they were as free as possible from picric acid. Dehydration was carried out in graded alcohol, the specimens staying in each concentration for 24 hours. Benzene was used as a clearing agent instead of xylol, since it was found not to render the specimens as hard as xylol. The clearing took 24 hours. The specimens were then transferred to a 50% mixture of benzene and paraffin for 48 hours in an incubator at 35°C, and finally to pure melted paraffin (M.P. = 50°C) in a specially devised vacuum paraffin oven, with a pressure of 7 cm. Hg. The paraffin used for infiltration was changed three times, with an interval of about 12 hours between each change. This process lasted 48 hours. The skin specimens were then embedded as usual in paraffin (M.P.- 52°C).
>
> The paraffin blocks prepared in this way were sectioned at a thickness of about 30 microns with a freezing microtome without using the freezing technique. The advantage of this microtome was that the knife was drawn slantwise along the edge of the block instead of cutting it in a perpendicular direction with consequent damage to the edge of the knife. Smooth and satisfactory sections were thus obtained.
>
> During the cutting of vertical sections, the paraffin sections were examined from time to time under a microscope to ensure that the plane of sectioning was parallel to the direction of the hairs. If not, the stage for the blocks was adjusted. When the horizontal sections were cut, care was taken to ensure that the skin surface was parallel with the plane of the knife in order to prepare sections which would present only one level of the skin.
>
> Both the vertical and horizontal sections of the skin were mounted in series, stained with Delafield haematoxylin and counter-stained with eosin in the usual way.

A few other techniques were tried but without much success. Among these were the dioxane method, the methyl-benzoate-celloidin double embedding method, and the xylol method. Their common fault was incomplete infiltration of paraffin or celloidin in the same length of time as was required in the benzene and vacuum paraffin method described on p.17. The pure benzene method without the vacuum device gave fairly satisfactory results with calf skin but did not give complete paraffin infiltration with cow skin, which was much tougher and thicker.

CHAPTER III

GENERAL MORPHOLOGY OF THE COW SKIN

Cow skin consists of two main layers, the epidermis and the corium (M and O in Plates 11, 12, 15, 16, 17, 18, 20, 21, 22). The former is composed of stratified epithelial cells while the latter is composed of dense connective tissue fibres and cells. Between these two layers there is a well defined and smooth boundary. The papillae which characterize the papillary layer in human skin are generally absent in cow skin except in the forehead region (P in Plate 24).

Each hair has its own hair follicle, usually accompanied by a 'sweat' gland, a group of sebaceous glands and an arrector pili muscle. These four organs, the hair follicle, the 'sweat' gland, the sebaceous gland and the arrector pili muscle form a unit (D, A, B and C in Plates 9, 10, 11, 18, 19, 21, 26). None of these structures is found apart from the others. This has been demonstrated in the present study after an examination of the vertical and horizontal sections of skin in 21 regions of six cows of different ages and also of one calf. Examinations of the sections of the back, the neck, the flank and the axilla in the skin of embryos has revealed the same thing. Hence this unit, composed of a hair follicle, a 'sweat' gland, a sebaceous gland and an arrector pili muscle, may conveniently be called 'a hair follicle unit'. It follows that the number of hair follicles or of hairs represents also the number

of any one of the other three components of the 'hair follicle unit'.

Epidermis The epidermis is a stratified epithelium (M in Plates 1, 2, 6, 7, 15, 18, 20, 21, 22). It may be clearly divided into two layers, the outer cornified layer, the corneum, and a deeper layer, the Malpighian layer (a and N in Plates 1, 2, 18, 19). No blood vessels are found in the epidermis.

Corium The corium is composed of dense connective tissue. In human skin it is differentiated into an upper papillary layer and a lower reticular layer. The papillary layer is characterized by the presence of prominent papillae, which obtrude into the concavities of the epidermal layer. However in cow skin, the papillae are generally absent and therefore the boundary line between the epidermis and the corium is smooth. When they are present, as in the forehead (P in Plate 24), they are less prominent than those in human skin.

The hair follicles with the associated organs, are located in the corium. The sebaceous glands are in the upper level near the middle of the hair follicles, while the 'sweat' glands are in a lower level near the roots of the hair follicles. The upper layer of the corium, containing the hair follicles and the associated organs is provided with more blood vessels especially capillaries, (see Chapter IX).

Hairs and Hair Follicles As described in Chapter V the distribution of the hairs in cow skin is equivalent to the distribution of 'sweat' glands in different regions of the body. Each hair arises from an invagination of the skin; hence the follicle wall is actually a continuation of the epidermal layer of the skin.

At the opening of the sebaceous gland the corneum of the epidermis lining the hair follicle begins to disappear, and further down from that point to the base of the hair follicle only the Malpighian layer remains.

Sebaceous Glands In embryo skin the sebaceous glands appear as a group of three to four cells of large size with round nuclei and shining cytoplasm loaded with fatty substance of higher refraction than the neighbouring elements (B in Plates 1, 2, 4).

In cow skin they consist of two pear-shaped lobes (B in Plates 11, 12 and 60). Each lobe is further divided into smaller lobes (B in Plate 62), typical of compound accinous glands. The sebaceous gland duct is very short and opens to the hair follicle cavity at a point about one-third of the distance from the skin surface to the root of the hair follicle (K in Plates 18, 21, 22, 23).

The sebaceous gland cells are fully distended and heavily loaded with fatty substance. The nuclei in normal cells are round or ovoid. In these cells near

the opening of the gland, the nuclei undergo degeneration; they shrink and become denser and more irregular in shape. The cells themselves become detached from the gland proper and are thrown out into the follicle cavity through the sebaceous gland opening (J in Plate 23). This is typical holocrine secretion.

Arrector Pili Muscle In the skin of a cattle embryo, one foot seven inches long, the arrector pili muscle has already taken its shape as a bundle of spindle-shaped smooth muscle cells. The location of this bundle in the skin remains the same throughout the life of the animal (C in Plates 1, 3, 4, 5). In cow skin it appears as a well-developed muscle band, inserted at one end in the lower portion of the hair follicle and at the other, in the uppermost portion of the corium near the epidermis (C in Plates 9, 14, 17, 19, 20, 21). Since the arrector pili muscle is one of the four components of the 'Hair Follicle Unit', the number of muscles per unit area of skin surface is equal to the number of hairs in the same unit area. The significance of such an arrangement in the heat conservation of the animal will be discussed later in Chapter XIII.

'Sweat' glands and the capillary distribution in the skin are discussed in Chapters IV and IX.

CHAPTER IV

THE 'SWEAT' GLANDS OF THE COW, THEIR SECRETIONS AND CAPILLARY SUPPLY

Since Gurlt (1835) first described the 'sweat' glands of the cow, they have been studied by a number of workers (e.g. Muto, 1926; Yamane and Ono, 1936; Kelley, 1935 and Dempsey, 1946). None of these workers has conclusively demonstrated that these glands secrete a liquid which evaporates from the surface of the skin and results in dissipation of heat. The function of the glands is still unknown. They are designated 'sweat' glands in the present study purely to differentiate them from sebaceous glands.

The 'sweat' glands of the Ayrshire cows which have been examined during the present investigations have been found to be a constant component of the 'Hair Follicle Unit' at all stages of life, i.e. in the embryo, calf, and adult cow. The 'sweat' gland in the embryonic skin takes the form of a single unbranched tube (A in Plates 1, 3, 4, 5). In the calf and adult cows it is fully differentiated into a bag-like gland and a slender gland duct (A in Plate 26). In certain regions of the 9 year-old cow, such as the forehead, the over-development of the gland results in the formation of convolutions (A in Plate 8).

The 'sweat' gland duct, which is sharply differentiated from the gland leads straight upwards from it. After crossing the arrector pili muscle and

passing through between the lobes of the sebaceous gland belonging to the same hair follicle, it opens on the skin surface as a funnel-shaped outlet near the emergence of the hair shaft (F in Plates 9, 10, 11, 19).

The gland is composed of two layers of epithelium, the outer myo-epithelium consisting of cells with spindle-shaped nuclei and the inner glandular epithelium composed chiefly of cells with round or ovoid nuclei, (I and H in Plates 25, 33, 34, 35, 36, 37, 38, 39). The resemblance of the myo-epithelial cells to the smooth muscle cells suggests that the expulsion of the secretion from the lumen may be accomplished in part by the contraction of the outer myo-epithelial layer of the gland. The longitudinal axis of the myo-epithelial cell is parallel with the longitudinal axis of the 'sweat' gland. This arrangement would help in the expulsive process.

The secretions of the 'sweat' glands are not always present in the lumen. When they are present, they do not have the same appearance even in the same section of the same body region. Plates 27, 28, 29, 30 and 31 show sections taken in the same thoracic region of the back of Cow II. Some of the products of secretion appeared as a homogeneous gel-like mass (Y in Plates 31 and 40). Despite the unknown effect of fixation, the products of secretion may be more fluid than histological examination suggested. In other lumen the products appeared as coarse (Y in Plates 27 and 35), or fine (Y in Plates 29 and 30)

granules. If the micro-photographs of secretory activity are selected and arranged in order according to the size of the granules, the series of pictures shown in Plates 33 to 40 is obtained, and the result suggests the probable successive stages of the transformation of the secretory products after they have been discharged from the gland cells lining the lumen. It is probable that in the final stage of the transformation, the secretion is of such a fluid and homogeneous nature that its passage along the duct is possible.

In Plates 43, 44 and 45, the origin of the secretion is to be seen in the form of a protuberance (b in the Plates) from the glandular epithelium lining the lumen wall. The secretion of the 'sweat' glands seems to be an intermittent process. After the formation of the first granule, there appears to be an interval before the appearance of the second granule from the same spot. The first one remains to be linked with the second one, which is in turn to be linked with the third so forming a chain of granules (b and Y in Plates 45 and 46). The granules eventually break off from the chain as the latter lengthens, and they remain for some time in the gland lumen to be transformed from coarse granules to fine granules and finally into a fluid homogeneous mass which can be discharged with ease. This is typical apocrine secretion. According to Schiefferdecker (1917, 1922) "the gland cells are not ruined by this process (the formation of the secreted

granules and their eventual breaking off) but return to their original form and continue to discharge a fluid secretion in a manner similar to that of the eccrine glands until fresh growth takes place. In the apocrine glands, therefore, there are two stages of secretion, the necrobiotic discharge and the simple secretion. Plate 32 shows that the secretion (Y in the Plates) in all the lumen of the 'sweat' glands from the sections of skin in the ventral region of the neck of the same animal (Cow II) was gel-like and hence was probably fluid before fixation (see also Plate 41). Whether this represents the storage of the final products of the transformation of the secretion from a previous apocrine secretion or the eccrine secretion of the gland preceding the next apocrine secretion is uncertain. In Plate 42 both coarse and fine granules can be seen in the same lumen and this seems to indicate that before the completion of the transformation process, the second apocrine secretion begins. Signs of exhaustion in the gland cells have been noted as illustrated in Plates 47, 48 and 49. In calf skin the secretion in the lumens of all the 'sweat' glands in the same section have the same gel-like appearance. The difficulty again arises as to whether they were stored from the preceding apocrine secretion or whether they were the products of eccrine secretion. Some light may be thrown on the

problem by a study of the capillary supply to the 'sweat' glands, since eccrine glands as they appear in human skin are characterized by a secretion largely composed of water, and therefore demand a close relation with the capillaries in order to obtain a sufficient supply of water.

In Plates 67, 68, 71 and 72 which show sections of the skin at the 'sweat' gland level, neither arterioles nor venules are found and the capillaries are few. Arterioles may be seen (U in Plates 69, 73, 74 and 75) but they do not send as many branches to the glands as would be expected if the glands were functioning as efficient eccrine glands. As shown in Plates 66, 69 and 76 (V), venules are found at the same level, but the capillary supply is either absent or very scarce in comparison with those just under the epidermis (W in Plates 54 to 59) and with those at the sebaceous gland level (X in Plates 60 to 63) which will be described in detail in Chapter IX. It may be concluded that the 'sweat' glands of the cow are definitely of the apocrine type. Although it is difficult to exclude the possibility that they may also assume the eccrine type of secretion in the interval between any two periods of apocrine secretion, yet, judging from the poor capillary supply at the 'sweat' gland level, it seems certain that as eccrine glands they must be very poor.

CHAPTER V

THE DISTRIBUTION OF THE 'SWEAT' GLANDS

Horizontal sections of the skin at a level just a little under the epidermis give the best picture of the distribution of the hair follicles. Near the hair follicle there is always a small ring or group of cells representing the cross section of a 'sweat' gland duct, (E in Plates 54, 55, 56, 57, 58 and 59). Each 'sweat' gland duct leads to one 'sweat' gland. Hence counting the number of hair follicles is equivalent to counting the number of 'sweat' ducts and so of the 'sweat' glands themselves.

A special device was made to render the counting much easier than by direct microscopic examination. The sections of the cow skin were projected by a microscope using a high intensity lamp and the counts made on the projected image. The microscope used for the projection was arranged with a 5 x eyepiece, a 1½ inch objective and a tube length of 180 mm. The apparatus was fixed and remained unchanged during the whole counting process. Constant magnification was thus maintained. The hair follicles in the field were counted first, then those hair follicles whose images fell on the margin of the field. Half the latter number added to the former was regarded as the total number of hair follicles in the area of the field.

A stage micrometer was projected on white paper with the same microscope arrangement. The projected

image of the micrometer was used as a scale to measure the diameter of the field. By means of the following equation, the area of the field was computed :-

$$A = \pi(\frac{d}{2})^2$$

where A = the area of the field and d = the diameter of the field.

The diameter of the field of the microscope used for counting was 0.388 cm. and the area 0.1182 sq. cm. Hence, the number of hair follicles per sq. cm. of skin surface could be calculated by multiplying the total number of hair follicles in the field by the factor 8.46 (i.e. $\frac{1}{0.1182}$). This, of course, was also the number of 'sweat' glands, sebaceous glands, and arrector pili muscles per sq. cm. of skin surface, since these three are constant components of the 'Hair Follicle Unit'.

Ten countings were made on three to six sections of cow skin taken from the twenty-one regions referred to on p. 15. The mean of the values obtsined for each of the regions of the 5 cows aged 3 to 4, of the one cow aged 9 and of the one calf are given in Table I. Standard errors and coefficients of variation with the range of the measurements for each cow have been tabulated separately for each animal in Tables XXXV to XLI.

It was necessary to find whether there was any difference in the distribution of 'sweat' glands in different regions of the body. The front flank was

arbitrarily chosen as a basic region for comparison with fifteen other regions for two reasons. Firstly, elimination of body heat by radiation, convection or evaporation from that region should be facilitated on account of its exposed position. Secondly, it is the most convenient region of the animal for physiological measurements such as skin temperature and perspiration rate.

The following fifteen regions have been compared with the front flank :-

1. Forehead
2. Lateral regions of the neck
3. Hind flank
4. Thoracic region of the back
5. Lumbar region
6. Sacral region
7. Gluteus
8. Abdomen
9. Udder
10. Axilla
11. Groin
12. Upper foreleg
13. Lower foreleg
14. Upper hind-leg
15. Lower hind-leg

The difference between the mean number of 'sweat' glands per sq. cm. of skin surface in the front flank region and that in the other regions to be compared was obtained by subtraction. The standard error of this difference was computed by means of the following equation :-

$$E_d = \sqrt{\frac{S_{ff}^2 + S_x^2}{n}}$$

where E_d = the standard error of the difference between

the means, S_{ff} = the standard deviations in the front flank region, S_x = the standard deviation in the other regions to be compared and n = the number of measurements. This equation was derived from the usual formula (Snedecor, 1940):-

$$E_d = \sqrt{E_{ff}^2 + E_x^2}$$

where, E_{ff} and E_x = the standard errors of the means in the same two regions.

The value of "t" was calculated and the probability of such differences being significant was found by referring to Table III of Fisher and Yates (1938).

It was found that the sacrum (back, sacral), the lower foreleg, the lower hind-leg and the gluteus were all statistically different from the front flank region in the number of 'sweat' glands per sq. cm. of skin surface as shown in Table XII.

Comparison of the cows of the 3 to 4 year old age group with the 9 year old cow was made by the same statistical method. It was found that the calf had more 'sweat' glands per sq. cm. of skin surface than the younger cows, and that the younger cows had more than the older cow (Table XI, 1).

The distribution of the 21 body regions according to the number of 'sweat' glands per sq. cm. of skin is illustrated in Table XLII.

Table XLII shows that the ventral and lateral regions of the neck (NV and NL) are the regions with

the greatest number of 'sweat' glands per unit area of skin since they are in the Mean + 2S.D. zone, while the sacrum, gluteus, udder, lower foreleg and lower hind-leg (BS, GL,UD,LF,LH) are the regions with the least number of 'sweat' glands per unit area, since they are all in the 'Mean - 2 S.D. zone'. The remainder of the regions are all in the Mean + S.D. zones.

Yamane and Ono (1936) claimed that in Zebu and other cattle the neck and shoulder had the greatest number of 'sweat' glands of all the regions while the udder had the least. The regions in the extremities were intermediate. This agrees in general with the present findings. However, it has been found that the distribution of 'sweat' glands in the upper parts of the fore and hind-legs are essentially different from the lower parts. Table XLII, shows that the upper foreleg (UF) and upper hind-leg (UH) regions are in the Mean - S.D. zone, while the lower foreleg and the lower hind-leg (LF and LH) are in the Mean - 2S.D. zone. The shoulder regions (SH) are in the Mean + 2S.D. and the Mean + S.D. zones.

The front flank (FF), the breat (BR), the thoracic region of the back (BT), the groin (GR) and the hind flank (HF) are in the Mean + S.D. zone while the abdomen (AB), the lumbar (BL), and the forehead region (FH) are in the Mean - S.D. zones.

CHAPTER VI

THE CIRCUMFERENCE AND THE LENGTH OF 'SWEAT' GLANDS

The 'sweat' glands as shown in both the vertical and horizontal sections of the skin are not fully distended but are more or less folded or convoluted. Their shape is so irregular (A in Plates 8, 10, 67, 68, 69, 72 and 73) that any kind of linear measurement is impossible. The following method was devised to overcome this difficulty.

The vertical and horizontal sections of the skin were projected on a sheet of white paper through a microscope. Outlines of the transverse and the longitudinal sections of the 'sweat' glands were traced from the projected image. The image of a stage micrometer was projected through the same microscope. Using the image of the micrometer as a scale, the perimeter of the transverse and longitudinal sections of the 'sweat' glands could be directly measured by means of a pair of dividers, despite the convolutions and foldings. Half the value of the perimeter of the longitudinal sections gave the length of the 'sweat' gland, and the perimeter of the cross section of the gland gave the'circumference' of the gland. It was thus possible to estimate the area of the inner surface of the lumen of a single gland by multiplying the average circumference by the average length of the 'sweat' gland, as described in detail in Chapter VII.

The length and the circumference of the 'sweat'

glands in 21 different body regions of six cows and one calf have been measured using 30 measurements for each region. The means with the standard deviations for the different regions of the different animals were calculated and are tabulated in Tables II and III. Averages of the means for the same regions of the five 3 to 4 year old cows were computed and are shown in the same tables.

It was found that in the gluteus, lower foreleg and lower hind-leg, the circumferences of the 'sweat' glands were larger than in the front flank, the difference being statistically significant (Table XIV). Comparison of the average lengths of the 'sweat' glands of the 15 regions of the five 3 to 4 year old cows with that of the front flank region showed no significant difference (Table XIII).

The cows of the 3 to 4 year old group were compared with the 9 year old cow and with the calf (Table XI, 2 and 3). The results showed that the 9 year old cow had the longest glands (0.762 mm.) and that the calf had the shortest (0.465 mm.). With the 3 to 4 year old cows the length was intermediate (0.649 mm. when all 21 regions were included, or 0.637 mm. when all the four leg regions were omitted.)

In the circumference of the 'sweat' glands no significant difference was found between the 9 year old cow and the five 3 to 4 year old cows, but significant differences existed between the younger cows and the calf in this respect (Table XI, 3).

Calculations were made by the usual procedure to determine whether there was a correlation between the number of 'sweat' glands per sq. cm. of skin and the length of the 'sweat' glands (Table XXII), between the number and the circumference (Table XXIII) and between the length and the circumference (Table XXIV). The results showed that there was a tendency, though not very significant, for the glands to be shorter and to have a small circumference the more numerous they were. They also showed that the larger the glands the greater was their circumference, but again the correlation was not significant.

The distribution of the different body regions according to the length and circumference of their 'sweat' glands is given in Table XLIII and XLIV. The first of these two tables shows that the longest 'sweat' glands were in the sacral and lower hind-leg regions (BS, LH) while Table XLIV shows that the glands with the greatest circumference were in the sacrum (BS). The glands with the smallest circumference occurred in the forehead (FH). This is in agreement with the findings recorded in Tables XIII and XIV.

The summary of all the measurements on the length and circumference of the 'sweat' glands are given in Tables XXXV, A to XLI, A.

CHAPTER VII

THE AVERAGE AREA OF THE SECRETING SURFACE OF A SINGLE 'SWEAT' GLAND

Knowing the circumference and the length of the 'sweat' glands in the different body regions, it is possible to calculate the approximate area of the secreting surface of a single 'sweat' gland by assuming the gland to be a hollow cylinder and multiplying its length by its circumference. It is realised that an error will be introduced by this assumption due to the irregular shape of the glands, but nevertheless it was believed that the area obtained in this way would be sufficiently accurate for comparative purposes. The area of the secreting surface of the gland is a measure of the gland's potential activity, and hence the importance of this measurement. The average area of secreting surface of a single 'sweat' gland in the different body regions of six cows and one calf are given in Table IV.

The area of the secreting surface of a single 'sweat' gland in 15 different body regions has been compared with that in the front flank as shown in Table XV. The area in the lateral region of the neck was significantly smaller than that in the front flank while that of the sacrum, the gluteus, the lower foreleg and the lower hind-leg were significantly larger.

From Table XLV it can be seen that the glands in the sacrum, the lower hind-leg and lower foreleg (BS, LH, LF) had the greatest area while those in the

lateral and dorsal region of the neck and the forehead region (NL, ND, FH) had the smallest area. Thus the results obtained by two different methods of comparison agreed with each other (Tables XV and XLV). Yamane and Ono (1936) claimed that the largest glands were found in the axilla, forehead and abdomen while the smallest were in the neck region, those of intermediate size being in the breast, gluteus and legs. Their conclusions were based on three different measurements, the length, the width and the number of convolutions of the glands instead of on a single entity such as the area of secreting surface of a single gland as in the present study. Since the circumference and the length of the 'sweat' glands are not closely correlated with each other and since the longest glands may not have the largest circumference it is difficult to judge the size of the glands from any one of these separate measurements. Hence their findings cannot be compared with those shown in Tables XV and XLV.

Comparison of the 3 to 4 year old group with the 9 year old cow and the calf (Table XI, 4) shows that the average area of secreting surface of a single 'sweat' gland for the 9 year old cow and the calf were 0.276 sq. mm. and 0.146 sq. mm. respectively, while that of the 3 to 4 year old group was 0.214 sq. mm. when 17 regions were counted and 0.223 sq. mm. when 21 body regions were counted. The differences between the three groups were highly significant.

Correlation coefficients were calculated between

the number of 'sweat' glands per sq. cm. of skin and the area of secreting surface of a single 'sweat' gland. The results are shown in Table XXV. In the 3 to 4 year old group,with the exception of Cow III, the coefficient of correlation ranged between -0.526 to -0.731. With Cow III only 16 instead of 21 body regions were taken into account, and the correlation coefficient was 0.010. Hence it seems that there was a significant negative correlation between the number of 'sweat' glands per unit area of skin and the average area of secreting surface of a single gland. There was a tendency for the area of secreting surface of a single 'sweat' gland to increase with the reduction of the number of the glands per unit area of skin. This tendency was demonstrated also in the 9 year old cow and in the 8-day old calf, which had correlation coefficients of -0.360 and -0.386. These coefficients were highly significant.

Comparison of the area of the secreting surface of the 'sweat' glands of the 3 to 4 year old cows and the 9 year old cow and also of the calf is illustrated in Table XI, 4. The area of secreting surface of a single gland of the 9 year old cow was larger than that of the younger cows, and the difference of 0.062 sq.mm. was significant. Similarly, the difference of 0.077 sq. mm. between those of the calf and of the 3 to 4 year old cows was also highly significant. That is, the older the cow, the greater was the area of the secreting surface of a single gland.

CHAPTER VIII

THE AREA OF THE SECRETING SURFACE OF THE 'SWEAT' GLANDS PER SQ. CM. OF SKIN SURFACE

Since the area of secreting surface of a single sweat gland was inversely correlated with the number of glands per unit area of skin, to know the area of only one gland would not be sufficient for the correct assessment of the secreting capacity in any body region. By multiplying the average area of the secreting surface of the glands in any body region by the number of the glands per sq. cm. of skin in the same region, the total area of the secreting surface of the sweat glands per sq. cm. of skin in that particular region can be obtained. In Table V the area of the secreting surface of the glands per sq. cm. of skin in the different body regions of all the cows and of one calf are given.

Reference to Table XVI shows that with the exception of the forehead, the sacral region and the lower hind-leg, none of the regions was statistically different from the front flank.

From Table XLVI it can be seen that the sacrum, (BS), forehead (FH), lower hind leg (LH) and udder (UD) regions had the smallest secreting surface of sweat glands per unit area of skin. The axilla (AX) and the upper hind-leg (UH) were regions with a large secreting surface. Most of the other regions including the front flank (FF) showed no significant differences. This is also shown by the results in

Table XIII where no significant differences were found between the front flank and the other regions. The only results which approached significance were those for the forehead, the sacrum and the lower hind-leg.

Table XI, 5 reveals that the areas of the secreting surface of the 'sweat' glands per sq. cm. of skin for the 17 body regions of the 9 year old cow and the 3 to 4 year old cows differed by only 0.44 sq. cm. which was not significant. On the other hand, between the 3 to 4 year old cows and the calf there was a difference of 10.87 sq. cm. which was highly significant. In fact, the secreting area in the calf was 3.7 times that in the cows. Evidently as age increases and surface area gets larger, the 'sweat' glands also become larger but their number per sq. cm. decreases. Thus it can be seen from Table XI, 1, that the calf had about 10,600 'sweat' glands per sq. cm. of skin as compared with 1,900 in the 3 to 4 year old cows, a ratio of 5.6. This is roughly the ratio which might well have existed between the surface area of the cows and that of the calf.

From Plates 50 to 53 for the calf it can be seen that all the lumens were well filled with secretion (Y in the Plates), whereas with the cows (Plates 67, 68, 70 and 71) many of the lumens were empty and others were only partially full. The evidence from both histological observations and measurements seem to suggest that the 'sweat' glands of the calf were more active than those of the cow.

CHAPTER IX

THE CAPILLARY DISTRIBUTION IN COW SKIN

Cow skin has two distinct layers, the epidermis and the corium. The epidermis does not possess any blood vessels. In the corium the following five levels may be easily identified (Plate 26) :-
(1) The sub-epidermal level. This corresponds roughly to the papillary layer and the uppermost portion of the reticular layer of human skin, but differs from it in that papillae are usually absent and even when present (P in Plate 24) are not so prominent as in human skin, (2) the sebaceous gland level, (3) the sub-sebaceous gland level, (4) the 'sweat' gland level, and (5) the sub-sebaceous gland level (not shown in Plate 26). The last four levels are all in the reticular layer.

In the sub-epidermal level, fine calibre capillaries anastomose to form a network, each loop of which encircles a hair follicle as illustrated in Plats 54 to 59, which are photographs of sections from the forehead, back and flank. This network is located in a position similar to that of rete sub-papillaries in human skin. Since papillae are usually absent from cow skin this capillary network may suitably be called rete sub-epidermius.

In the sebaceous gland level, no such regular network of capillaries occurs. As shown in the vertical sections of skin (X in Plates 10, 12, 13 and

14) capillaries can be seen running from the sub-sebaceous gland level almost vertically to the sub-epidermal level and sending fine branches to supply the sebaceous glands (X in Plates 60, 61 and 62). It can be seen also that the capillary supply in this level is quite good though not so good as in the sub-epidermal level.

In the sub-sebaceous gland level, arterioles, venules and capillaries are found surrounding groups of two, three or more hair follicles as shown in Plates 63, 64 and 65 (U, V and X in the Plates). These sections resemble the transverse sections of cow skin in the sub-epidermal level since each hair follicle is accompanied by a small circle, the cross-section of the 'sweat' gland duct. The only difference is the presence of the arrector pili muscle near its point of attachment to the hair follicle.

In the 'sweat' gland level, arteries (S in Plate 70) and veins (T in Plate 76) are found while the capillaries are very scarce in comparison with those in the sub-epidermal and sebaceous gland levels. The general impression is that the capillary supply to the 'sweat' glands is exceedingly sparse, unlike that of the sebaceous glands. At the level near the terminal ends of the 'sweat' glands, capillaries are even fewer and arterioles and venules are also sparse. Deeper still, only a small number of main arterial trunks and veins are found in the meshwork of the connective fibres of the reticular layers of the skin.

It is seen that main branches of arteries and veins are found in the deeper level of the skin. As the arteries reach the 'sweat' gland level, they begin to branch off and probably supply all the 'sweat' glands, but this supply is almost certainly too small to allow the 'sweat' glands of the cow to discharge the function of 'sweating' as efficiently as human sweat glands. The arterioles branch further and when they reach the sebaceous gland level they pass the gland in a vertical direction and at the same time send fine branches to supply the glands (X in Plates 60 and 61). After this the arterioles merge themselves with capillaries, and finally the latter form a capillary network, each loop of which encircles a hair follicle. Since this capillary network is very near to the epidermis and since on the average the epidermis is 0.01 mm. thick, it is possible for water to diffuse from the capillaries through the thin epidermis to the skin surface and so supply moisture for insensible perspiration. The proximity of the capillary network to the skin surface must also facilitate the cooling of warm blood brought to the periphery.

In the next two chapters, the capillary surface measurements in the sub-epidermal level of the skin are discussed. At this level the distribution of capillaries is regular and relatively easy to measure.

CHAPTER X

THE CIRCUMFERENCE OF THE CAPILLARY LOOPS AND THE DIAMETER OF THE CAPILLARIES IN THE SUB-EPIDERMAL LEVEL OF THE SKIN

The fact that each hair follicle is surrounded by a capillary loop of the capillary network in the sub-epidermal level of the skin makes it possible to estimate the area of the capillary surface at this level, if the average diameter of the capillaries, the circumference of the capillary loops and the number of capillary loops per sq. cm. of skin surface are known. The latter number is equal to the number of hair follicles, or the number of 'sweat' glands per sq. cm. of skin, as given in Table I. The circumference of the capillary loops and the diameter of the capillaries can be measured in the same way as the length and circumference of the 'sweat' glands were measured, by tracing the image of the capillaries and capillary loops projected through a microscope and using as a scale the image of a stage micrometer projected from the same microscope with the same magnification (p.33). The results of these measurements are recorded in Tables VI and VII.

The results in Table XVIII indicate that there was no significant difference between the diameters of the capillaries in any region and those of the capillaries in the front flank region. The values ranged from 0.037 mm. in the groin to 0.053 mm. in the

udder with an average for all the regions of 0.046 mm. This is almost identical with that for the front flank (0.045 mm.).

Table XLVIII, shows that the sacrum (BS) and the udder (UD) tended to have capillaries with the largest diameters and that the forehead (FH) and the groin (GR) had capillaries with the smallest diameters.

Turning now to the circumference of the capillary loops, it will be found that there was a significant difference between the front flank and the forehead, sacral, gluteal, udder, lower foreleg and lower hind-leg regions (Table XVII). From Table XLVII,B, it can be seen that the sacrum, the gluteus, the udder, the lower foreleg and the lower hind-leg (BS, GL, UD, LF, LH) had the capillary loops with the greatest circumference, a fact which can also be seen from Table XVII. The axilla and shoulder regions (AX, SH) had the capillary loops with the smallest circumferences.

It will be seen from Table XXVII that the correlation coefficients between the number of capillary loops per sq. cm. of skin and the circumference of the loops ranged from -0.7599 to -0.9173 in the 3 to 4 year old cow and were highly significant. Those of the 9 year old cow and the 8-day old calf were lower but significant. These significant correlations would be expected since each capillary loop is one unit of the continuous capillary network and the perimeter of one loop shares a portion of the perimeters of several

other neighbouring loops. Hence it follows that the less the number of capillary loops in a unit area of skin surface, the larger the circumference of the loop will be.

There was a tendency for larger capillary loops to consist of capillaries of large diameter, but as shown in Table XXVIII, the correlation coefficients were low and were significant for only two of the seven animals studied. Comparison of the circumference of the capillary loops and the diameter of the capillaries of the animals revealed that the 9 year old cow possessed the largest circumference loops, the calf the smallest, and the 3 to 4 year old cows the intermediate values. These differences were statistically significant (Table XI, 6).

It would be expected that the diameter of capillaries of the 3 to 4 year old cows would approach more closely that of the 9 year old cow than that of the calf. The difference in this respect between the 9 year old cow and the 3 to 4 year old cows was only 0.001 mm. and was not significant. That between the 3 to 4 year old cows and the calf was 0.014 mm. and was significant. This is consistent with the fact that the older cow possessed the largest capillary loops and also that larger capillary loops tended to have capillaries with larger diameters as shown in Table XXVIII.

The measurements of the circumference of the capillary loops and the diameter of the capillaries are given in Table XXXV, B to XLI, B.

CHAPTER XI

THE AREA OF THE CAPILLARY SURFACE PER SQUARE CENTIMETER OF SKIN AT THE SUB-EPIDERMAL LEVEL OF THE SKIN

If the diameter of the capillaries, the circumference of the capillary loops at the sub-epidermal level of the skin and the number of capillary loops per sq. cm. of skin are known, it is possible to calculate the area of the capillary surface per sq. cm. of skin at the sub-epidermal level by means of the equation :-

$$A = \frac{C \times \pi d}{2} \times N$$

where A = the area of the capillary surface per sq. cm. of skin, C = the circumference of the capillary loop, which is equal to the length of the portion of the capillary concerned, d = the diameter of the capillary and N = the number of capillary loops per sq. cm. of skin.

Since each hair follicle shares a capillary loop with the neighbouring hair follicles only half of the area of the capillary surface of one capillary loop is allocated to one hair follicle; hence the necessity to divide by 2 in the equation.

The area of capillary surface thus calculated for the differeht regions of the six cows and one calf are given in Table VIII.

Table XI, 8 shows that the calf had the largest

capillary surface per sq. cm. of skin (2.107 sq. cm.) and that the 9 year old cow, the smallest (0.883 sq. cm.) while the 3 to 4 year old cows had intermediate values (average 1.065 sq. cm.). All these differences were highly significant.

Comparison of the results for the 15 other regions with those for the front flank region showed that there was no statistically significant difference in the area of the capillary surface per sq. cm. of skin in those various regions. However, in the forehead, sacral, lower foreleg and lower hind-leg regions the area of capillary surface per unit area of skin tended to be smaller. This would be expected since the number of capillary loops per unit area of skin in these regions was also smaller.

Table XLIX shows that for those of the five 3 to 4 year old cows, the ventral region of the neck (NV) had the greatest area of capillary surface per sq. cm. of skin, while the sacrum and the lower foreleg (BS and LF) had the least.

CHAPTER XII

THE THICKNESS OF SKIN AND THE DEPTH OF THE 'SWEAT' GLANDS

The thickness of the skin and the depth of the 'sweat' glands in the different regions of the cows and the calf were measured directly as before (p.33). The results are given in Tables IX and X.

Comparison of the thickness of the skin in 15 body regions with that of the skin of the front flank showed that only in the abdomen and the udder regions was the skin significantly thinner than the front flank region (Table XX).

From Table L it may be seen that the front flank, the hind flank, the ventral region of the neck and the lower hind-leg, (FF, HF, NV, LH) were the regions with the thickest skin, while the abdomen, the cheek and the udder (AB, CH, UD) had the thinast skin. This agrees with the results in Table XX. Comparison of the depth of the 'sweat' glands in the different regions showed that only in the forehead region were the glands deeper than in the front flank region (Table XXI).

From Table LI it can be seen that the forehead, the ventral region of the neck and the upper hind-leg (FH, NV and LH) were the regions in which the 'sweat' glands were the deepest. In all the other regions there was little difference in depth.

The correlation coefficients between the thickness of the skin and the depth of the 'sweat' glands (Table XXX) were low and were not significant. There was no significant correlation between the number of 'sweat' glands, the area of the secreting surface of the glands or the area of capillary surface of the rete sub-epidermius per unit area of skin and the thickness of the skin (Tables XXXI to XXXIII).

The difference in the thickness of the skin between the 3 to 4 year old cows and the calf was highly significant, while the difference between the 9 year old cow and the 3 to 4 year old cows was not (Table XI, 9). The same was true of the depth of the 'sweat' glands.

The measurements on the thickness of the skin and on the depth of the 'sweat' glands are given in Tables XXXV, C to XLI, C.

CHAPTER XIII

DISCUSSION

When the present work began it was believed that no detailed histological work had been done on the 'sweat' glands of bovine skin, but later it was found that a paper on the subject had been published by the two Japanese workers, Yamane and Ono. The paper appeared in 1936 in the Memoirs of the Faculty of Science of the Taikoku Imperial University, a publication which is not generally available. Both in the Japanese and in the present work 21 body regions were studied and of these 21 regions 16 were examined in both sets of work. There was, however, no undesirable overlapping since the types of animals studied in the two investigations were different. The 16 regions which were common to both are shown in Table LII. The Japanese workers studied the skins of two water buffalloes, two Sind Zebus, one Kankrej Zebu, two Formosian animals, one Holländer bull and an eight months old Holländer calf, but no Ayrshires, whereas the present work was confined to seven animals all of the Ayrshire breed.

Unfortunately it is not possible to determine from the results in Table LII whether the cattle native to tropical countries have more 'sweat' glands per unit area of skin than European cattle. It might be thought from the table that the Zebu cattle had almost the same number of 'sweat' glands as the Ayrshire cows, but it

must be realised that the figures do not lend themselves to close comparison since they would first have to be corrected for age and sex and this is not possible when only so few animals of each type and sex have been studied. The intention is that the present work should be extended to include animals native to the tropics with the object of obtaining more definite information of this type.

Yamane and Ono investigated the secretory activity of the 'sweat' glands but not in detail. They concluded that the secretion of the glands of the buffallo was apocrine whereas that of all the other cattle was eccrine. In the present work, however, the 'sweat' glands of the Ayrshire cows have been shown to be apocrine. Whether there is in fact a fundamental difference in this respect between Ayrshire and Zebu cattle is a matter which can only be decided by extending the present work to include a detailed study of Zebu skin.

According to Schieferdecker (1917, 1922) apocrine glands have a complex secreting process with a necrobiotic discharge similar to those shown in Plates 33 to 45, alternating with simple eccrine secretion. Ogata (1934) demonstrated in man that the secretion from the apocrine axillary glands could be induced by both mental and thermal stimuli. It appears from this that apocrine 'sweat' glands can assume the function of sweating, a function which reaches a very high degree of efficiency in the 'sweat'

glands of the horse which are of apocrine type, but which secret fluid for the evaporation which is so necessary with such an active animal in order to dissipate the large amount of heat which it produces. It may be that in the course of evolution the 'sweat' glands of tropical cattle have developed and become specialized as evaporative mechanisms like those of the horse, but as already indicated, to prove or disprove this hypothesis will require further study of the 'sweat' glands of tropical cattle and their capillary supply.

Yamane and Ono did not study the capillary supply to the 'sweat' glands, whereas much of the present work was devoted to this particular aspect of the problem. It was concluded from the results that the capillary supply was so poor in Ayrshire cows that the 'sweat' glands must be very inefficient as eccrine glands, if indeed they function in that way at all.

In the present work, although five 3 to 4 year old cows were studied, it has been possible so far to deal with only one 9 year old cow and one 8 day old calf. It is important, however, to note the principal differences which were observed between the animals which differed widely in age. The first is in the number of 'sweat' glands per unit area of skin. The number was greatest in the calf and least in the oldest cow. This may be explained by suggesting that during growth the area of skin increases without any increase in the actual number of hairs and

associated glands. In fact the ratio of the number of 'sweat' glands per unit area in the calf to that in the cow was very similar to the ratio which would be expected for the surface area of the cow to that of the calf. Factors which appeared to increase significantly with age were the length of the 'sweat' glands and the area of the secreting surface of the average 'sweat' gland. The area of secreting surface per unit area of skin, however, tended to decrease with age. Similarly, the diameter of the capillaries and the capillary loops were greater in the cows than in the calf, but the area of capillary surface per unit area of skin was less. From these observations it seems that the secreting surface of the 'sweat' glands per unit area of skin and the capillary surface per unit area of skin at the sub-epidermal level depend on the number of glands and loops in the area, more than on other factors such as the circumference and length of the 'sweat' glands, the circumference of the capillary loops or the diameter of the capillaries at sub-epidermal levels.

Associated with each 'sweat' gland and hair follicle in bovine skin is an arrector pili muscle, and in the sub-epidermal level of the skin there was found to be a capillary network which was named the rete sub-epidermius. Since both the hairs and the arrector pili muscles have the same orientation, the contraction of the arrector pili muscle in any one region will exert a considerable amount of force in

one direction. The pulling of the hair follicle roots towards the epidermius by the contracted arrector pili muscle will squeeze the rete sub-epidermius and retard the blood circulation. This mechanism will help the vaso-constrictor mechanism to reduce the blood flow nearer the skin surface and thus increase heat conservation. The erection of hairs which will occur at the same time, will also increase the insulating effect of the hair coat. The arrector pili muscles and the rete sub-epidermius will in this way work together to conserve or dissipate heat. When the muscle is contracted, blood circulation nearer the surface of the skin will be reduced and the hairs will be erected. When the arrector pili muscle is not contracted the hairs will not be erected and the blood flow to the skin will be increased. Whether the arrector pili muscles of tropical cattle are as well developed as those of cattle of temperate areas is a matter for future investigation.

SUMMARY

1. Twenty-one different regions of the skins of five 3 to 4 year old Ayrshire cows, one 9 year old Ayrshire cow and an 8 day old Ayrshire calf have been examined histologically in an attempt to determine the distribution and structure of the 'sweat' glands and their mode of secretion. The capillary supply in the skin and of the sebaceous and 'sweat' glands was also studied.

2. The number, length and circumference of the 'sweat' glands and the area of their secreting surface were determined and the results statistically analysed. The diameters of the capillaries, the circumference of the capillary loops and the surface area of the capillaries of the capillary network at the sub-epidermal level were also measured and analysed.

3. It was established that in all the body regions each hair follicle was invariably associated with a 'sweat' gland and also with a group of sebaceous glands and an arrector pili muscle. This inseparable combination was named a 'hair follicle unit'.

4. The number of 'sweat' glands per unit area of skin was much greater in the calf than in the cows.

5. The secreting surface of the 'sweat' glands of the calf was found to be larger than that of the cow per unit area of skin, but in this respect no

significant difference was found between the five 3 to 4 year old cows and the 9 year old cow.

6. The area of the secreting surface of the 'sweat' glands per unit area of skin was least in the sacral, forehead, lower hind-leg and udder regions. Other regions differed little from each other in this respect.

7. The area of the capillary surface in the rete sub-epidermius per unit area of skin was greatest in the ventral region of the neck and in the upper foreleg and least in the sacral and lower fore and hind-leg regions.

8. The 'sweat' glands were found to be apocrine, and the sebaceous glands holocrine.

9. A capillary network was observed to be present in the sub-epidermal level of the corium in all the body regions. It was named the rete sub-epidermius.

10. Each hair follicle was encircled by one capillary loop of the rete sub-epidermius.

11. The area of the capillary surface of the rete sub-epidermius per unit area of skin was less for the 9 year old cow than for the 3 to 4 year old cows.

12. The sebaceous glands were well supplied with capillaries, but the capillary supply of the 'sweat' glands was so poor that it seemed unlikely that they could obtain sufficient fluid to make their secretion

of any importance in the dissipation of heat by evaporation from the skin surface.

13. The contracting arrector pili muscle in addition to its normal function may also exert pressure on the rete sub-epidermius and thus reduce heat loss by retarding blood flow in the capillaries.

REFERENCES

Benedict, F.G. and Ritzman, E.G. (1923). Undernutrition in Steers. Relation to Metabolism, Digestion and Subsequent to Re-alimentation. Carnegie Inst. Washington Pub. No. 324.

Benedict, F.G. and Ritzman, E.G. (1927). The Metabolism of Fasting Steers. Carnegie Inst. Washington Pub. No. 377.

Bonsma, J.C. and Pretorius, A.J. (1943). Influence of Colour of Coat and Coat Cover on Adaptability of Cattle. Farming in South Africa, 18, 101.

Brody, S. (1945). Bioenergetics and Growth. Reinhold Publ. Co., New York.

Dempsey, M. (1946). 'Sweat' Glands. Nature, 157, 513.

Diem, F. (1907). Beitroge zur Entwicklung der Schweissdrussen an der behaarten Haut der Saugetiere. Ant. Hefte I. Abt. Bd. 34. (cited by Yamane and Ono, 1936).

Fisher, R.A. and Yates, F. (1938). Statistical Tables, Oliver and Boyd, London.

Freeborn, S.B., Regan, W.M. and Berry, L.J. (1934). The Effect of Petroleum Fly-Sprays on Dairy Cattle. J. Econ. Entom. 27, 382.

Gaalaas, R.F. (1945). Effect of Atmospheric Temperature on Body Temperature and Respiration Rate of Jersey Cattle. J. Dairy Sci. 30, 79.

Gaalaas, R.F. (1947). A Study of Heat Tolerance in Jersey Cows. J. Dairy Sci. 30, 79.

Gurlt, (1835). Vergleichende Untersuchung uber die Haut des Menschen und der Haussaugetiere, beconders in Beziehung auf die Absonderungsorgane des Hauttalges und des Schweisses, Berlin. (cited by Yamane and Ono, 1936).

Hardy, J.D. and Du Bois, E.F. (1938). Basal Metabolism, Radiation, Convection and Vaporization at Temperatures of 22 to 35°C. J. Nutrit. 15, 477.

Kelley, R.B. (1932). Zebu (Brahman) Cross Cattle and their Possibilities in North Australia. Commonwealth of Australia, Council for Scientific and Industrial Research, Pamphlet No.27.

Krögh, A. (1929). The Anatomy and Physiology of Capillaries. 2nd edit. Philadelphia.

Kuno, Y. (1934). The Physiology of Human Perspiration. Churchhill, London.

Marks, (1895). Untersuchungen uber die Entwicklung der Haut inbesondere der Haare und Drusen. Inaug-Diss. Berlin. (cited by Yamane and Ono, 1936).

Muto, K. (1935). A Histological Study of the Sweat Glands of Mammals. J.Jap.Soc.Vet.Sci. 4, 1.

Ogata, K. (1934). Observations on the Thermal and Mental Sweatings on the Human Axilla. J. Orient. Med. (cited by Kuno, 1934).

Paterson, D.D. (1939). Statistical Technique in Agricultural Research, McGraw-Hill, New York.

Quinlan, J. and Riemerschmidt, G. (1941). A Preliminary Note on the Temperature of the Scrotal Skin of the Bull and its Relation to Air, Skin and Body Temperature. Onderstepoort J. Vet. Sci. 16, 299.

Riemerschmidt, G. (1943). Some Aspects of Solar Radiation in its Relation to Cattle in South Africa and Europe. Onderstepoort J. Vet. Sci. 18, 327.

Riemerschmidt, G. and Elder, J.S. (1944). The Absorption for Solar Radiation of Different Coloured Hairy Coats of Cattle. Onderstepoort J. Vet. Sci. 20, 223.

Regan, W.M. and Richardson, G.A. (1938). Reactions of the Dairy Cow to Changes in Environmental Temperature. J. Dairy Sci. 21, 73.

Rhoad, A.O. (1944). The Iberia Heat Tolerance Test for Cattle. Tropical Agriculture, 21, 162.

Rhoad, A.O. (1938). Some Observations on the Response of Pure-bred Bos taurus and Bos indicus cattle and their Cross-bred types to certain Conditions of Environment. Proc. Amer. Soc. Anim. Prod. p. 284.

Seath, D.M. (1947). Heritability of Heat Tolerance in Dairy Cattle. J. Dairy Sci. 30, 137.

Seath, D.M. and Miller, G.D. (1947). Heat Tolerance Comparisons between Jersey and Holstein Cows. J. Anim. Prod. 6, 24.

Seath, D.M. and Miller, G.D. (1946). The Relative Importance of High Temperature and High Humidity as Factors Influencing the Respiration Rate, Body Temperature and Pulse Rate of Dairy Cows. J. Dairy Sci. 29, 465.

Schiefferdecker, P. (1917). Die Hautdrusen des Menschen und der Saugetiere, Ihre biolog., und rassenanatomische Bedeutung, sowie die Muscularis sexualis. (Vorlaufige Mitteilung). Biol. Zbl. 37, S. 534. (cited by Kuno, 1934).

Schiefferdecker, P. (1922). Die Hautdrusen des Menschen u. der Saugetiere, Ihre biol. und rassenanation. Bedeutung. sowie Muscularies sexualis. Stuttgart.(cited by Kuno, 1934).

Snedecor, G.W. (1940). Statistical Methods. Iowa State College Press.

Winslow, C.-E.A. (1941). Man's Heat Exchanges with His Thermal Environment. Temperature, its Measurement and Control in Science and Industry, p.509. American Institute of Physics. Reinhold Publishing Corporation, New York.

Winslow, C., Herrington, L.P. and Gagge, A.P. (1937). Physiological Reactions of the Human Body to Varying Temperatures. Amer.J.Physiol. 120, 1.

Wimpheimer, C. (1926). Zu Entwicklung der Schweissdrussen der behaarten Haut. Anat. Hefte. 1, Abt. Bd. 34. (cited by Yamane and Ono, 1936).

Yamane, J. and Ono, Y. (1936). Rassenanatomische Untersuchungen der Hautstructure vom Buffel, Zebu, Formosarind, und Friesch-Hollander in Hinblick auf das Problem der Tropenanpassung. Mem. Fac. Sci. and Agric. Taikoku Imperial University, XIX, (3).

INDEX TO THE TABLES

XVII. Comparison of the average circumference of the capillary loops at the sub-epidermal level of skin in different body regions of the five 3 to 4 year old cows.

XVIII. Comparison of the average diameter of the capillaries at the sub-epidermal level of skin in different body regions of the five 3 to 4 year old cows.

XIX. Comparison of the average area of the capillary surface per square centimeter of skin surface in different body regions of the five 3 to 4 year old cows.

XX. Comparison of the average thickness of the skin in different body regions of the five 3 to 4 year old cows.

XXI. Comparison of the average depth of the 'sweat' glands in different body regions of the five 3 to 4 year old cows.

XXII. Correlation between the length and the number of 'sweat' glands per sq. cm. of skin surface.

XXIII. Correlation between the circumference and the number of 'sweat' glands per sq.cm. of the skin surface.

XXIV. Correlation between the length and the circumference of the 'sweat' glands.

XXV. Correlation between the area of the secreting surface of a single 'sweat' gland and the number of 'sweat' glands per sq.cm. of skin surface.

XXVI. Correlation between the area of the secreting surface of 'sweat' glands per sq.cm. of skin surface and the number of 'sweat' glands per sq. cm. of skin surface.

XXVII. Correlation between the circumference of the capillary loops and the number of hairs per sq. cm. of skin surface.

XXVIII. Correlation between the diameter of capillaries and the circumference of the capillary loops at the sub-epidermal level of the skin.

XXIX. Correlation between the area of capillary surface per sq. cm. of skin surface at the sub-epidermal level and the number of hairs per sq. cm. of the skin.

TABLE I

THE NUMBER OF 'SWEAT' GLANDS PER SQUARE CENTIMETER OF SKIN SURFACE

Body Regions	AGE							
	3 to 4 years						9 years	8 days
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow 1	Calf
Forehead	1669 ± 74	1655 ± 58	1638 ± 66	1730 ± 123	1302 ± 289	1598 ± 169	903 ± 86	11,170 ± 380
Cheek	2019 ± 125	2878 ± 139	2310 ± 122	1663 ± 148	1957 ± 145	2165 ± 459	1470 ± 154	9,786 ± 460
Neck (dorsal)	2287 ± 158	2556 ± 131	2243 ± 143	1663 ± 148	2083 ± 131	2166 ± 329	1827 ± 98	13,385 ± 1040
Neck (lateral)	2128 ± 61	2502 ± 260	2999 ± 255	2360 ± 98	1999 ± 179	2398 ± 389	1776 ± 169	12,405 ± 1140
Neck (ventral)	3307 ± 180	2519 ± 233	2478 ± 160	2117 ± 99	2117 ± 124	2508 ± 486	1808 ± 118	13,755 ± 560
Back (thoracic)	2805 ± 182	2766 ± 96	1663 ± 170	1814 ± 93	2276 ± 119	2265 ± 526	1101 ± 63	13,155 ± 590
Back (lumbar)	1574 ± 101	2823 ± 144	1142 ± 46	1067 ± 102	1428 ± 62	1607 ± 710	1087 ± 50	13,455 ± 1040
Back (sacral)	730 ± 57	1740 ± 211	940 ± 73	689 ± 90	706 ± 118	961 ± 446	665 ± 35	10,205 ± 1300
Front flank	2510 ± 280	2992 ± 142	1663 ± 168	1873 ± 64	1705 ± 96	2149 ± 581	1743 ± 122	15,285 ± 1310
Hind flank	2161 ± 147	2587 ± 270	1722 ± 173	1126 ± 49	1806 ± 86	1880 ± 542	1185 ± 121	16,335 ± 2770
Shoulder	2067 ± 120	-	2419 ± 127	2142 ± 89	2318 ± 78	2236 ± 160	1821 ± 142	12,320 ± 750
Gluteus	1642 ± 73	1636 ± 105	941 ± 64	1126 ± 67	1117 ± 203	1292 ± 326	1165 ± 114	11,360 ± 1020
Breast	2573 ± 212	2697 ± 198	1428 ± 213	1756 ± 83	2092 ± 127	2109 ± 536	1421 ± 115	11,225 ± 1050
Abdomen	1918 ± 238	2798 ± 181	1487 ± 47	1529 ± 67	1630 ± 78	1871 ± 544	1327 ± 125	12,860 ± 1780
Udder	2389 ± 208	1911 ± 207	1109 ± 287	808 ± 122	1092 ± 142	1462 ± 661	969 ± 97	3,709 ± 1550
Axilla	2977 ± 138	3331 ± 237	2218 ± 500	2142 ± 80	1554 ± 160	2444 ± 708	1117 ± 83	5,400 ± 380
Groin	2651 ± 192	2742 ± 94	1814 ± 92	1848 ± 137	1663 ± 119	2144 ± 511	1503 ± 115	11,660 ± 730
Upper fore leg	3128 ± 135	-	1982 ± 267	1016 ± 84	1621 ± 114	1937 ± 888	1658 ± 113	8,845 ± 800
Lower fore leg	1146 ± 93	-	991 ± 60	-	865 ± 92	1000 ± 141	1291 ± 180	4,660 ± 700
Upper hind leg	2329 ± 94	-	2176 ± 117	2386 ± 53	1982 ± 81	2218 ± 181	1261 ± 150	4,930 ± 650
Lower hind leg	819 ± 105	-	754 ± 30	-	1075 ± 87	882 ± 170	931 ± 92	6,555 ± 590

TABLE II

THE LENGTH OF 'SWEAT' GLANDS (mm.)

Body Regions	AGE							
	3 - 4 years						9 years	8 days
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf
Forehead	0.760 ±0.033	0.486 ±0.054	0.680 ±0.109	0.528 ±0.058	0.670 ±0.096	0.625 ±0.114	1.068 ±0.082	0.420 ±0.080
Cheek	0.504 ±0.052	0.607 ±0.080	0.599 ±0.027	0.547 ±0.057	0.656 ±0.151	0.582 ±0.059		0.346 ±0.047
Neck (dorsal)	0.647 ±0.082	0.605 ±0.055	0.578 ±0.083	0.517 ±0.050	0.618 ±0.081	0.593 ±0.049	0.670 ±0.097	0.382 ±0.069
Neck (lateral)	0.630 ±0.036	0.573 ±0.066	0.578 ±0.068	0.565 ±0.094	0.546 ±0.060	0.578 ±0.003	0.739 ±0.097	0.369 ±0.045
Neck (ventral)	0.692 ±0.039	0.588 ±0.102	0.599 ±0.089	0.562 ±0.070	0.655 ±0.090	0.619 ±0.053	0.624 ±0.090	0.379 ±0.039
Back (thoracic)	0.565 ±0.037	0.665 ±0.097	0.634 ±0.066	0.601 ±0.106	0.602 ±0.083	0.615 ±0.038	0.747 ±0.044	0.349 ±0.057
Back (lumbar)	0.657 ±0.074	0.706 ±0.103	0.624 ±0.074	0.680 ±0.133	0.826 ±0.132	0.698 ±0.077	0.847 ±0.046	0.374 ±0.065
Back (sacral)	0.788 ±0.117	0.816 ±0.133	0.706 ±0.094	0.627 ±0.094	0.759 ±0.116	0.739 ±0.075	0.861 ±0.051	0.521 ±0.011
Front flank	0.600 ±0.041	0.628 ±0.326	0.631 ±0.076	0.652 ±0.111	0.742 ± 121	0.650 ±0.055	0.656 ±0.042	0.442 ±0.061
Hind flank	0.569 ±0.034	0.607 ±0.089	0.630 ±0.093	0.538 ±0.051	0.704 ± 094	0.609 ±0.063	0.680 ±0.138	0.402 ±0.056
Shoulder	0.504 ±0.032		0.634 ±0.080	0.571 ±0.061	0.665 ±0.069	0.593 ±0.071	0.633 ±0.008	0.491 ±0.055
Gluteus	0.710 ±0.034	0.592 ±0.061	0.633 ±0.081	0.586 ±0.051	0.672 ±0.093	0.638 ±0.053		0.483 ±0.066
Breast	0.514 ±0.032	0.579 ±0.070	0.725 ±0.101	0.561 ±0.061	0.658 ±0.089	0.607 ±0.084	0.690 ±0.102	0.526 ±0.098
Abdomen	0.681 ±0.040	0.634 ±0.064	0.632 ±0.061	0.552 ±0.024	0.620 ±0.079	0.624 ±0.046	0.751 ±0.108	0.504 ±0.087
Udder	0.741 ±0.036	0.589 ±0.103	0.635 ±0.075	0.556 ±0.094	0.660 ±0.085	0.636 ±0.071	0.828 ±0.154	0.532 ±0.106
Axilla	0.693 ±0.058	0.604 ±0.071	0.669 ±0.097	0.636 ±0.099	0.653 ±0.075	0.651 ±0.034	0.757 ±0.088	0.466 ±0.057
Groin	0.776 ±0.199	0.614 ±0.053	0.628 ±0.081	0.587 ±0.082	0.624 ±0.082	0.646 ±0.074	0.729 ±0.134	0.456 ±0.052
Upper fore leg	0.648 ±0.197		0.603 ±0.078	0.606 ±0.092	0.689 ±0.080	0.636 ±0.041	0.776 ± .072	0.608 ±0.078
Lower fore leg	0.758 ±0.138		0.784 ±0.136		0.830 ±0.134	0.791 ±0.036		0.629 ±0.099
Upper hind leg	0.808 ±0.242		0.645 ±0.121	0.651 ±0.113	0.710 ±0.141	0.703 ±0.076	0.893 ± .111	0.490 ±0.083
Lower hind leg	0.830 ±0.172		0.766 ±0.130		0.769 ±0.126	0.788 ±0.036		0.598 ±0.134

TABLE III

THE CIRCUMFERENCE OF 'SWEAT' GLANDS (mm.)

Regions	AGE							
	3 - 4 years						9 years	8 days
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf
Forehead	0.315 ±0.081	0.274 ±0.048	0;241 ±0.040	0.339 ±0.098	0.225 ±0.066	0.279 ±0.048	0.285 ±0.043	0.276 ±0.046
Cheek	0.225 ±0.053	0.273 ±0.049	0.292 ±0.067	0.354 ±0.078	0.340 ±0.076	0.297 ±0.052	0.353 ±0.055	0.301 ±0.063
Neck (dorsal)	0.307 ±0.056	0.262 ±0.043	0.276 ±0.062	0.331 ±0.071	0.290 ±0.066	0.293 ±0.030	0.402 ±0.101	0.273 ±0.065
Neck (lateral)	0.315 ±0.050	0.258 ±0.059	0.272 ±0.076	0.339 ±0.073	0.272 ±0.075	0.291 ±0.035	0.407 ±0.072	0.327 ±0.074
Neck (ventral)	0.352 ±0.061	0.341 ±0.080	0.277 ±0.064	0.314 ±0.072	0.266 ± .053	0.310 ±0.038	0.340 ±0.046	0.307 ±0.019
Back (thoracic)	0.317 ±0.063	0.246 ±0.043	0.314 ±0.060	0.336 ±0.072	0.299 ±0.071	0.302 ±0.034	0.357 ±0.076	0.287 ±0.064
Back (lumbar)	0.415 ±0.064	0.267 ±0.064	.325 ±0.098	0.424 ±0.086	0.374 ±0.065	0.361 ±0.066	0.440 ±0.122	0.292 ±0.052
Back (sacral)	0.498 ±0.034	0.248 ±0.064	.373 ±0.089	0.428 ±0.087	0.480 ±0.033	0.405 ±0.100	0.459 ±0.034	0.337 ±0.064
Front flank	0.332 ±0.068	0.337 ±0.045	.298 ±0.076	0.382 ±0.064	0.261 ±0.053	0.322 ±0.045	0.344 ±0.021	0.322 ±0.072
Hind flank	0.358 ±0.084	0.303 ±0.068	.298 ±0.085	0.382 ±0.077	0.321 ±0.073	0.332 ±0.036	0.415 ±0.032	0.294 ±0.056
Shoulder	0.351 ±0.073		.299 ±0.064	0.302 ±0.187	0.339 ±0.061	0.323 ±0.026	0.326 ±0.069	0.259 ±0.061
Gluteus	0.375 ±0.066	0.352 ±0.063	.385 ±0.038	0.419 ±0.095	0.406 ±0.021	0.387 ±0.025	0.402 ±0.043	0.274 ±0.050
Breast	0.355 ± .075	0.330 ±0.085	.402 ±0.088	0.399 ±0.097	0.403 ±0.075	0.378 ±0.033	0.376 ±0.070	0.383 ±0.090
Abdomen	0.369 ± .033	0.273 ±0.049	.514 ±0.079	0.294 ± .059	0.449 ±0.070	0.380 ±0.102	0.358 ±0.070	0.310 ±0.056
Udder	0.331 ± .065	0.257 ±0.046	.436 ±0.055	0.314 ± .053	0.399 ±0.090	0.347 ±0.071	0.345 ±0.032	0.297 ±0.052
Axilla	0.314 ± .089	0.258 ±0.071	.326 ±0.067	0.241 ± .049	0.415 ±0.089	0.311 ±0.068	0.353 ±0.070	0.325 ±0.081
Groin	0.312 ± .049	0.274 ±0.056	.279 ±0.054	0.277 ± .039	0.587 ±0.172	0.346 ±0.136	0.298 ±0.082	0.343 ±0.070
Upper fore leg	0.397 ± .094		.307 ±0.099	0.288 ± .046	0.455 ±0.074	0.382 ±0.078	0.351 ±0.093	0.354 ±0.083
Lower fore leg	0.335 ±.073		.377 ±0.035		0.451 ±0.100	0.388 ±0.018	0.404 ±0.069	0.297 ±0.070
Upper hind leg	0.296 ± .059		.317 ±0.038	0.256 ± .060	0.417 ±0.075	0.321 ±0.069	0.331 ±0.059	0.358 ±0.086
Lower hind leg	0.368 ± .051		.406 ±0.037		0.447 ±0.078	0.407 ±0.039	0.331 ±0.063	0.343 ± .058

TABLE IV

THE AREA OF SECRETING SURFACE OF A SINGLE 'SWEAT' GLAND (sq.mm.)

Body Regions	AGE							
	3 - 4 years						9 years	8 days
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf
Forehead	0.239	0.133	0.164	0.179	0.151	0.173 ±0.041	0.304	0.116
Cheek	0.113	0.166	0.175	0.194	0.223	0.174 ±0.041	-	0.104
Neck (dorsal)	0.199	0.159	0.160	0.171	0.179	0.173 ±0.016	0.269	0.104
Neck (lateral)	0.198	0.148	0.157	0.192	0.149	0.168 ±0.024	0.300	0.121
Neck (ventral)	0.244	0.201	0.166	0.176	0.174	0.192 ±0.032	0.212	0.116
Back (thoracic)	0.179	0.164	0.199	0.202	0.180	0.184 ±0.016	0.267	0.100
Back (lumbar)	0.273	0.189	0.203	0.288	0.309	0.252 ±0.053	0.373	0.109
Back (sacral)	0.392	0.202	0.263	0.268	0.364	0.297 ±0.078	0.395	0.176
Front flank	0.199	0.211	0.188	0.249	0.194	0.208 ±0.024	0.226	0.147
Hind flank	0.204	0.184	0.188	0.206	0.226	0.201 ±0.017	0.282	0.118
Shoulder	0.177	-	0.190	0.172	0.225	0.191 ±0.024	0.206	0.127
Gluteus	0.266	0.208	0.244	0.246	0.273	0.247 ±0.025	-	0.132
Breast	0.183	0.191	0.291	0.221	0.265	0.230 ±0.047	0.259	0.201
Abdomen	0.251	0.173	0.325	0.162	0.278	0.237 ±0.070	0.269	0.156
Udder	0.245	0.151	0.277	0.175	0.263	0.222 ±0.056	0.286	0.158
Axilla	0.218	0.156	0.218	0.153	0.271	0.215 ±0.050	0.267	0.151
Groin	0.242	0.168	0.175	0.163	0.366	0.236 ±0.086	0.217	0.156
Upper foreleg	0.257	-	0.185	0.175	0.313	0.232 ±0.065	0.272	0.215
Lower foreleg	0.254	-	0.296	-	0.374	0.308 ±0.061	-	0.187
Upper hindleg	0.239	-	0.204	0.167	0.296	0.226 ±0.055	0.296	0.175
Lower hindleg	0.305	-	0.311	-	0.344	0.320 ±0.021	-	0.205

TABLE V

THE AREA OF THE SECRETING SURFACE OF 'SWEAT' GLANDS PER SQUARE CENTIMETER OF SKIN SURFACE (sq.cm.)

Body Regions	AGE							
	3 - 4 years						9 years	8 days
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf
Forehead	3.99	2.20	2.69	3.10	1.97	2.79 ±0.253	2.74	13.0
Cheek	2.29	4.78	4.04	3.23	4.36	3.73 ±0.993	-	10.2
Neck (dorsal)	4.55	4.06	3.59	2.84	3.73	3.75 ±0.630	4.91	13.9
Neck (lateral)	4.21	3.70	4.71	4.53	2.98	4.02 ±0.699	5.33	15.0
Neck (ventral)	8.07	5.06	4.11	3.73	3.68	4.93 ±0.840	3.83	16.0
Back (thoracic)	5.02	4.54	3.31	3.66	4.10	4.12 ±0.681	2.94	13.2
Back (lumbar)	4.30	5.34	2.32	3.07	4.40	3.89 ±1.190	4.05	14.7
Back (sacral)	2.86	3.52	2.47	1.85	2.57	2.65 ±0.608	2.63	18.0
Front flank	4.99	6.31	3.13	4.66	3.31	4.48 ±1.131	4.29	22.5
Hind flank	4.41	4.76	3.33	2.32	4.08	3.78 ±0.972	3.34	19.3
Shoulder	3.66	-	4.60	3.68	5.22	4.29 ±0.759	3.75	15.6
Gluteus	4.37	3.40	2.30	2.77	3.05	3.18 ±0.778	-	15.0
Breast	4.71	5.15	4.16	3.88	5.54	4.68 ±0.684	3.68	22.6
Abdomen	4.80	4.84	4.83	2.48	4.53	4.29 ±1.020	3.59	20.1
Udder	5.85	2.88	3.07	1.41	2.81	3.20 ±1.620	2.77	5.9
Axilla	6.49	5.20	4.84	3.28	4.21	4.80 ±1.190	2.98	8.2
Groin	6.42	4.61	3.17	3.01	6.09	4.66 ±1.590	3.26	18.2
Upper foreleg	8.04	-	3.67	1.78	5.07	4.64 ±2.640	4.50	19.0
Lower foreleg	2.91	-	2.93	-	3.24	3.02 ±0.185	-	8.7
Upper hind leg	5.57	-	4.44	3.98	5.87	4.96 ±0.900	3.72	8.6
Lower hind leg	2.50	-	2.35	-	3.70	2.85 ±0.740	-	13.4

TABLE VI

THE CIRCUMFERENCE OF CAPILLARY LOOPS AT THE SUB-EPIDERMAL LEVEL OF SKIN (mm.)

Regions	AGE							
	3 - 4 years						9 years	8 days
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf
Forehead	0.730 ±0.069	0.848 ±0.036	0.940 ±0.197	0.848 ±0.119	0.948 ±0.160	0.862 ±0.088	1.275 ±0.164	0.409 ±0.096
Cheek	0.733 ±0.049	0.628 ±0.062	0.700 ±0.024	0.803 ±0.065	0.860 ±0.117	0.745 ±0.090	0.920 ±0.086	0.355 ±0.052
Neck Dorsal	0.730 ±0.102	0.690 ±0.085	0.732 ±0.047	0.743 ±0.109	0.778 ±0.070	0.734 ±0.032	0.878 ±0.086	0.359 ±0.071
Neck Lateral	0.820 ±0.145	0.655 ±0.056	0.758 ±0.089	0.748 ±0.066	0.838 ±0.133	0.763 ±0.072	0.985 ±0.082	0.359 ±0.003
Neck Ventral	0.625 ±0.087	0.638 ±0.096	0.705 ±0.050	0.853 ±0.064	0.815 ±0.089	0.727 ±0.103	0.843 ±0.212	0.347 ±0.041
Back Thoracic	0.598 ±0.089	0.673 ±0.057	0.825 ±0.099	0.765 ±0.088	0.775 ±0.107	0.727 ±0.029	0.965 ±0.152	0.414 ±0.064
Back Lumbar	0.735 ±0.077	0.730 ±0.078	0.885 ±0.101	1.060 ±0.356	0.890 ±0.147	0.860 ±0.136	0.940 ±0.136	0.404 ±0.058
Back Sacral	1.133 ±0.098	0.903 ±0.075	1.043 ±0.225	1.003 ±0.067	1.095 ±0.152	1.035 ±0.089	1.052 ±0.162	0.398 ±0.076
Front Flank	0.685 ±0.077	0.650 ±0.061	0.800 ±0.077	0.768 ±0.087	0.798 ±0.130	0.740 ±0.069	0.748 ±0.103	0.414 ±0.063
Hind Flank	0.685 ±0.114	0.750 ±0.055	0.863 ±0.118	0.985 ±0.079	0.850 ±0.152	0.826 ±0.115	0.978 ±0.404	0.364 ±0.037
Shoulder	0.600 ±0.055		0.618 ±0.087	0.723 ±0.104	0.730 ±0.063	0.667 ±0.068	0.673 ±0.120	0.348 ±0.047
Gluteal	0.833 ±0.181	0.830 ±0.082	1.000 ±0.073	1.008 ±0.146	1.068 ±0.130	0.947 ±0.109	0.975 ±0.092	0.525 ±0.107
Breast	0.655 ±0.084	0.670 ±0.051	0.808 ±0.106	0.825 ±0.150	0.743 ±0.087	0.740 ±0.077	1.010 ±0.097	0.407 ±0.051
Abdomen	0.730 ±0.050	0.718 ±0.053	0.733 ±0.135	0.890 ±0.105	0.830 ±0.105	0.780 ±0.076	1.100 ±0.077	0.382 ±0.037
Udder	0.723 ±0.087	0.875 ±0.176	1.000 ±0.154	1.103 ±0.188	0.988 ±0.092	0.937 ±0.145	0.873 ±0.141	0.367 ±0.095
Axilla	0.628 ±0.055	0.608 ±0.072	0.778 ±0.063	0.718 ±0.141	0.730 ±0.059	0.692 ±0.072	0.668 ±0.065	0.446 ±0.052
Groin	0.738 ±0.066	0.708 ±0.066	0.778 ±0.105	0.803 ±0.112	0.823 ±0.087	0.770 ±0.047	0.958 ±0.132	0.386 ±0.037
Upper Foreleg	0.888 ±0.071		0.788 ±0.086	1.040 ±0.113	0.768 ±0.076	0.871 ±0.124	0.835 ±0.151	0.443 ±0.041
Lower Foreleg	0.828 ±0.038		1.120 ±0.104		1.128 ±0.100	1.025 ±0.171	0.735 ±0.056	0.518 ±0.071
Upper Hindleg	0.690 ±0.088		0.931 ±0.123	0.620 ±0.056	0.773 ±0.091	0.753 ±0.134	0.833 ±0.098	0.447 ±0.080
Lowe Hindleg	1.078 ±0.059		1.108 ±0.150		1.110 ±0.170	1.098 ±0.018	0.970 ±0.093	0.503 ±0.070

TABLE VII

THE DIAMETER OF CAPILLARIES AT THE SUB-EPIDERMAL LEVEL OF SKIN (mm.)

Body Regions	AGE							
	3-4 years						9 years	8 days
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf II
Forehead	0.049 ±0.024	0.039 ±0.011	0.039 ±0.012	0.038 ±0.010	0.053 ±0.019	0.043 ±0.0069	0.048 ±0.015	0.029 ±0.007
Cheek	0.041 ±0.016	0.044 ±0.009	0.036 ±0.015	0.045 ±0.014	0.045 ±0.014	0.042 ±0.0026	0.055 ±0.013	0.030 ±0.007
Neck (Dorsal)	0.047 ±0.015	0.043 ±0.013	0.031 ±0.011	0.044 ±0.010	0.047 ±0.014	0.042 ±0.0021	0.046 ±0.009	0.032 ±0.006
Neck (Lateral)	0.044 ±0.011	0.045 ±0.011	0.035 ±0.009	0.044 ±0.010	0.044 ±0.018	0.042 ±0.0042	0.045 ±0.009	0.028 ±0.004
Neck (Ventral)	0.042 ±0.014	0.050 ±0.010	0.041 ±0.009	0.043 ±0.014	0.054 ±0.026	0.046 ±0.0057	0.042 ±0.011	0.030 ±0.006
Back (Thoracic)	0.039 ±0.016	0.048 ±0.011	0.057 ±0.020	0.044 ±0.012	0.047 ±0.015	0.047 ±0.0021	0.042 ±0.009	0.030 ±0.008
Back (Lumbar)	0.044 ±0.013	0.039 ±0.007	0.061 ±0.029	0.045 ±0.010	0.050 ±0.015	0.047 ±0.0083	0.049 ±0.011	0.032 ±0.007
Back (Sacral)	0.051 ±0.017	0.050 ±0.009	0.063 ±0.018	0.043 ±0.016	0.053 ±0.015	0.052 ±0.0072	0.047 ±0.017	0.030 ±0.006
Front Flank	0.038 ±0.013	0.047 ±0.010	0.041 ±0.013	0.047 ±0.008	0.054 ±0.019	0.045 ±0.0062	0.042 ±0.011	0.034 ±0.008
Hind Flank	0.044 ±0.012	0.049 ±0.012	0.056 ±0.018	0.050 ±0.010	0.048 ±0.013	0.049 ±0.0044	0.053 ±0.013	0.037 ±0.009
Shoulder	0.042 ±0.009	0	0.038 ±0.012	0.043 ±0.011	0.051 ±0.014	0.043 ±0.0054	0.044 ±0.013	0.029 ±0.006
Gluteus	0.045 ±0.014	0.051 ±0.012	0.058 ±0.023	0.044 ±0.010	0.059 ±0.022	0.051 ±0.0070	0.058 ±0.013	0.03 ±0.006
Breast	0.037 ±0.011	0.050 ±0.010	0.070 ±0.024	0.043 ±0.013	0.053 ±0.015	0.050 ±0.0125	0.049 ±0.009	0.029 ±0.007
Abdomen	0.045 ±0.011	0.039 ±0.015	0.067 ±0.024	0.037 ±0.009	0.051 ±0.020	0.047 ±0.0120	0.046 ±0.009	0.032 ±0.009
Udder	0.044 ±0.012	0.048 ±0.008	0.070 ±0.023	0.050 ±0.011	0.053 ±0.016	0.053 ±0.0101	0.053 ±0.011	0.032 ±0.009
Axilla	0.038 ±0.014	0.040 ±0.012	0.046 ±0.016	0.037 ±0.009	0.056 ±0.015	0.043 ±0.0025	0.052 ±0.016	0.037 ±0.008
Groin	0.044 ±0.009	0.042 ±0.007	0.052 ±0.003	0.011 ±0.011	0.039 ±0.012	0.037 ±0.0156	0.047 ±0.011	0.033 ±0.008
Upper Foreleg	0.043 ±0.013		0.062 ±0.021	0.039 ±0.009	0.045 ±0.012	0;047 ±0.0104	0.038 ±0.009	0.033 ±0.009
Lower Foreleg	0.040 ±0.009		0.056 ±0.014		0.049 ±0.014	0.048 ±0.0025	0.040 ±0.013	0.032 ±0.008
Upper Hindleg	0.041 ±0.008		0.059 ±0.022	0.037 ±0.009	0.047 ±0.012	0.046 ±0.0030	0.048 ±0.017	0.033 ±0.007
Lower Hindleg	0.041 ±0.012		0.068 ±0.031		0.051 ±0.019	0.053 ±0.0136	0.045 ±0.013	0.039 ±0.010

TABLE VIII

THE AREA OF CAPILLARY SURFACE PER SQUARE CENTIMETER OF SKIN SURFACE AT THE SUB-EPIDERMAL LEVEL (sq.cm.)

Body Regions	AGE – 3 - 4 years						9 years	8-day calf
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf
Forehead	0.938	0.861	0.943	0.875	1.027	0.928 ±0.066	0.867	2.089
Cheek	0.955	1.249	0.915	0.943	1.190	1.050 ±0.156	1.169	1.644
Neck (dorsal)	1.233	1.194	0.801	0.855	1.198	1.056 ±0.210	1.160	2.423
Neck (lateral)	1.207	1.158	1.248	1.220	1.159	1.198 ±0.038	1.236	1.972
Neck (ventral)	1.366	1.262	1.125	1.219	1.465	1.281 ±0.257	1.005	2.242
Back (thoracic)	1.027	1.402	1.227	0.960	1.302	1.183 ±0.186	0.702	2.565
Back (lumbar)	0.798	1.265	0.968	0.799	0.998	0.996 ±0.248	0.787	2.731
Back (sacral)	0.663	1.235	0.971	0.466	0.643	0.796 ±0.305	0.516	1.908
Front flank	1.024	1.439	0.856	1.062	1.154	1.107 ±0.226	0.859	3.378
Hind flank	1.022	1.495	1.307	0.872	1.158	1.171 ±0.242	0.964	3.463
Shoulder	0.819	-	0.893	1.045	1.354	1.028 ±0.237	0.847	1.959
Gluteus	0.967	1.086	0.857	0.785	1.106	0.960 ±0.140	1.086	2.517
Breast	0.978	1.419	1.269	0.980	1.295	1.188 ±0.205	1.106	2.077
Abdomen	0.989	1.231	1.146	0.790	1.089	1.048 ±0.167	1.055	2.469
Udder	1.195	1.261	1.220	0.701	0.899	1.055 ±0.244	0.704	0.682
Axilla	1.116	1.272	1.247	0.895	0.998	1.106 ±0.161	0.609	1.399
Groin	1.355	1.281	1.154	0.955	0.838	1.117 ±0.217	1.063	2.320
Upper Foreleg	1.877	-	1.532	0.648	0.880	1.232 ±0.566	0.836	2.026
Lower Foreleg	0.596	-	0.976	-	0.752	0.841 ±0.191	0.596	1.216
Upper Hind leg	1.036	-	1.876	0.859	1.130	1.225 ±0.447	0.792	1.144
Lower Hind leg	0.568	-	0.891	-	0.956	0.805 ±0.207	0.639	2.019

TABLE IX

THE THICKNESS OF COWSKIN (mm.)

Body Regions	AGE							
	3 - 4 years						9 years	8 days
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf II
Forehead	4.55 ±0.205	4.79 ±0.184	3.6 ±0.249	5.31 ±0.337	5.19 ±0.095	4.68 ±0.680	4.39 ±0.534	2.52 ±0.22
Cheek	2.20 ±0.188	1.53 ±0.126	4.61 ±0.207	4.1 ± 0.077	3.23 ±0.298	3.13 ±1.276	—	2.17 ±0.24
Neck (dorsal)	4.50 ±0.122	5.42 ±0.148	4.45 ±0.295	6.31 ±0.110	6.29 ±0.145	5.39 ±0.913	4.66 ±0.321	2.05 ±0.25
Neck (lateral)	3.85 ±0.212	5.07 ±0.105	4.93 ±0.148	5.76 ±0.114	5.0 ±0.105	4.92 ±0.686	4.72 ±0.308	3.00 ±0.12
Neck (ventral)	4.66 ±0.344	6.41 ±0.170	6.41 ±0.443	6.23 ±0.077	5.82 ±0.109	5.91 ±0.737	5.02 ±0.342	2.4 ±0.26
Back (thorax)	4.76 ±0.141	5.21 ±0.070	4.24 ±0.283	5.33 ±0.063	5.67 ±0.239	5.04 ±0.554	5.89 ±0.507	1.5 ±0.13
Back (lumbar)	4.80 ±0.226	5.17 ±0.105	4.37 ±0.249	6.0 ± 0.114	6.15 ±0.170	5.29 ±0.760	5.07 ±0.302	1.68 ±0.14
Back (sacral)	4.50 ±0.155	5.89 ±0.134	4.71 ±0.203	5.07 ±0.130	6.91 ±0.134	5.42 ±0.989	6.64 ±0.548	1.68 ±0.11
Front flank	4.21 ±0.241	6.13 ±0.060	5.2 ± 0.215	6.86 ±0.181	5.48 ±0.308	5.58 ±0.996	4.82 ±0.305	3.05 ±0.18
Hind flank	5.08 ±0.105	6.2 ± 0.160	4.43 ±0.326	5.99 ±0.634	6.74 ±0.095	5.68 ±0.924	4.68 ±0.155	2.56 ±0.12
Shoulder	4.52 ±0.114	-	3.62 ±0.209	5.02 ±0.187	4.9 ±0.176	4.51 ±0.634	5.19 ±0.439	1.37 ±0.11
Gluteus	4.84 ±0.109	4.84 ±0.110	4.35 ±0.403	5.99 ±0.118	4.62 ±0.173	4.93 ±0.627	- -	1.63 ±0.13
Breast	3.08 ±0.130	5.22 ±0.140	4.31 ±0.184	5.01 ±0.317	6.21 ±0.495	4.76 ±1.162	3.48 ±0.148	1.87 ±0.16
Abdomen	2.97 ±0.134	3.41 ±0.070	3.89 ±0.164	3.61 ±0.189	3.66 ±0.084	3.39 ±0.277	3.32 ±0.210	1.85 ±0.094
Udder	3.31 ±0.273	2.73 ±0.034	3.76 ±0.317	4.79 ±0.512	5.08 ±0.338	3.93 ±0.983	3.87 ±0.366	1.90 ±0.17
Axilla	4.78 ±0.130	-	4.43 ±0.283	3.94 ±0.189	5.06 ±0.346	4.55 ±0.483	4.55 ±0.328	1.48 ±0.094
Groin	4.65 ±0.152	3.78 ±0.130	5.19 ±0.221	5.55 ±0.327	3.85 ±0.114	4.60 ±0.789	3.82 ±0.297	1.58 ±0.081
Upper foreleg	3.01 ±0.071	-	4.65 ±0.158	5.67 ±0.149	3.69 ±0.145	4.25 ±1.158	-	1.65 ±0.081
Lower foreleg	4.32 ±0.089	-	4.60 ±0.089	-	5.91 ±0.190	4.94 ±0.849	-	1.71 ±0.081
Upper hindleg	4.76 ± 0.105	-	4.73 ±0.078	4.79 ±0.154	4.83 ±0.130	4.78 ±0.043	4.01 ±0.351	1.77 ±0.14
Lower hindleg	5.48 ±0.277	-	5.64 ±0.063	-	6.39 ±0.316	5.84 ±0.486	-	1.70 ±0.081

TABLE X

THE DEPTH OF 'SWEAT' GLANDS (mm.)

Body Regions	AGE							
	3 - 4 years						9 Years	8 Days
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf
Fore head	2.06 ±0.221	1.34 ±0.094	1.83 ±0.144	1.51 ±0.033	1.83 ±0.148	1.71 ±0.287	1.79 ±0.414	1.51 ±0.028
Cheek	1.13 ±0.098	1.53 ±0.126	1.14 ±0.148	1.57 ±0.066	1.43 ±0.077	1.36 ±0.212	-	0.66 ±0.090
Neck (dorsal)	1.33 ±0.098	1.64 ±0.067	1.06 ±0.134	2.00 ±0.126	1.78 ±0.089	1.56 ±0.371	1.26 ±0.189	0.72 ±0.080
Neck (lateral)	1.05 ±0.126	1.62 ±0.081	1.05 ±0.164	1.43 ±0.081	1.42 ±0.077	1.31 ±0.254	1.11 ±0.151	0.68 ±0.013
Neck (ventral)	1.19 ±0.109	2.13 ±0.012	1.65 ±0.104	1.96 ±0.021	1.64 ±0.094	1.71 ±0.359	1.21 ±0.151	0.62 ±0.080
Back (thoracic)	1.25 ±0.094	1.48 ±0.104	1.46 ±0.134	1.42 ±0.125	1.44 ±0.134	1.41 ±0.092	1.63 ±0.238	0.63 ±0.100
Back (lumbar)	1.32 ±0.100	1.55 ±0.066	1.04 ±0.134	1.50 ±0.000	1.59 ±0.109	1.38 ±0.239	1.12 ±0.089	0.85 ±0.030
Back (sacral)	1.15 ±0.083	1.74 ±0.094	1.53 ±0.176	1.26 ±0.104	1.73 ±0.130	1.48 ±0.269	1.40 ±0.122	0.79 ±0.060
Front flank	1.07 ±0.094	1.49 ±0.075	1.14 ±0.114	1.41 ±0.074	1.30 ±0.063	1.28 ±0.177	1.03 ±0.063	1.05 ±0.110
Hind flank	1.16 ±0.044	1.26 ±0.141	0.95 ±0.083	1.20 ±0.167	1.51 ±0.094	1.22 ±0.202	0.92 ±0.063	0.94 ±0.070
Shoulder	1.15 ±0.070	-	0.88 ±0.078	1.56 ±0.115	1.53 ±0.141	1.28 ±0.326	1.18 ±0.122	0.67 ±0.090
Gluteus	1.31 ±0.074	1.57 ±0.094	0.93 ±0.067	1.21 ±0.120	1.38 ±0.063	1.28 ±0.236		0.62 ±0.060
Breast	1.01 ±0.074	1.22 ±0.011	1.32 ±0.100	1.51 ±0.137	1.44 ±0.148	1.30 ±0.197	1.07 ±0.094	1.01 ±0.11
Abdomen	1.04 ±0.054	1.31 ±0.075	1.07 ±0.104	1.17 ±0.081	1.36 ±0.104	1.19 ±0.142	1.07 ±0.130	0.97 ±0.17
Udder	1.20 ±0.126	1.19 ±0.100	0.96 ±0.063	1.66 ±0.176	1.49 ±0.158	1.30 ±0.275	1.15 ±0.083	0.77 ±0.08
Axilla	1.44 ±0.081	-	1.06 ±0.030	1.36 ±0.163	1.41 ±0.164	1.05 ±0.175	1.25 ±0.181	0.58 ±0.06
Groin	1.48 ±0.014	1.26 ±0.066	1.36 ±0.063	1.40 ±0.182	1.37 ±0.094	1.37 ±0.079	1.20 ±0.167	0.69 ±0.03
Upper foreleg	1.50 ±0.044		1.75 ±0.070	1.79 ±0.057	1.40 ±0.089	1.29 ±0.190		0.80 ±0.00
Lower foreleg	1.00 ±0.081		1.88 ±0.089	1.66 ±0.170	2.26 ±0.170	1.36 ±0.528		0.87 ±0.04
Upper hindleg	1.59 ±0.120		1.65 ±0.170	1.15 ±0.282	1.95 ±0.170	1.27 ±0.330	1.33 ±0.114	0.75 ±0.07
Lower hindleg	1.51 ±0.120		1.73 ±0.077	0.60 ±0.222	1.83 ±0.114	1.42 ±0.561		0.72 ±0.06

TABLE XI

MEASUREMENTS OF THE 9-YEAR OLD COW, 8-DAY OLD CALF AND FIVE 3-4YEAR OLD COWS COMPARED

Items	Animals to be compared	Mean of the measurements of n body regions: Animal	N	Mean	Difference between the means	Standard error of the difference between the means	t	Degrees of freedom	Probability	Significance
1. No. of 'sweat' glands per sq. cm. of skin surface	A Old cow & young cows	Old Cow	21	1335 ± 345	536	132	4.06	40	0.001-	++
		Young cows	21	1871 ± 501						
	B Calf & young cows	Calf	21	10593 ± 3633	8722	2530	3.45	40	0.01-	++
		Young cows	21	1871 ± 501						
2. Length of 'sweat' glands (mm.)	A Old cow & young cows	Old cow	17	0.762 ± 0.112	0.125	0.029	4.31	32	0.001-	++
		Young cows	17	0.637 ± 0.043						
	B Calf & young cows	Calf	21	0.465 ± 0.085	0.184	0.022	8.40	40	0.001-	++
		Young cows	21	0.649 ± 0.062						
3. Circumference of 'sweat' glands (mm.)	A Old cow & young cows	Old cow	21	0.365 ± 0.049	0.024	0.014	1.72	40	0.05+	n.s.
		Young cows	21	0.341 ± 0.041						
	B Calf & young cows	Calf	21	0.312 ± 0.032	0.029	0.0114	2.54	40	0.02-	+
		Young cows	21	0.341 ± 0.041						
4. Area of secreting surface of a single sweat gland (sq.cm.)	A Old cow & young cows	Old cow	17	0.276 ± 0.051	0.062	0.0147	4.21	32	0.001-	++
		Young cows	17	0.214 ± 0.033						
	B Calf & young cows	Calf	21	0.146 ± 0.036	0.077	0.0124	6.21	40	0.001-	++
		Young cows	21	0.223 ± 0.044						
5. Area of secreting surface of 'sweat' glands per sq. cm. of skin surface (sq.cm.)	A Old cow & young cows	Old cow	17	3.67 ± 0.775	0.44	0.804	0.54	32	0.50+	n.s.
		Young cows	17	4.11 ± 0.706						
	B Calf & young cows	Calf	21	14.81 ± 4.68	10.87	1.03	10.55	40	0.001-	++
		Young cows	21	3.94 ± 0.746						
6. Circumference of capillary loops at the sub-epidermal, level of skin (mm.)	A Old cow & Young cows	Old cow	21	0.915 ± 0.143	0.091	0.403	2.25	40	0.05-	+
		Young cows	21	0.824 ± 0.121						
	B Calf & young cows	Calf	21	0.409 ± 0.054	0.415	0.091	4.56	40	0.001-	++
		Young cows	21	0.824 ± 0.121						
7. Diameter of capillaries (mm.)	A Old cow & young cows	Old cow	21	0.047 ± 0.0051	0.0009	0.00144	0.62	40	0.50+	n.s.
		Young cows	21	0.046 ± 0.0042						
	B Calf & Young cows	Calf	21	0.032 ± 0.0029	0.140	0.00124	11.20	40	0.001-	++
		Young cows	21	0.046 ± 0.0042						
8. Area of capillary surface per sq.cm. of skin surface at the sub-epidermal level of skin (sq.cm.)	A Old cow & young cows	Old cow	21	0.883 ± 0.197	0.182	0.058	3.50	40	0.01-	++
		Young cows	21	1.065 ± 0.138						
	B Calf & young cows	Calf	21	2.107 ± 0.673	1.042	0.157	6.64	40	0.001-	++
		Young cows	21	1.065 ± 0.138						
9. Thickness of skin (mm.)	A Old cow & young cows	Old cow	16	4.633 ± 0.831	0.269	0.838	0.32	30	0.70+	n.s.
		Young cows	16	4.902 ± 0.655						
	B Calf & young cows	Calf	21	1.909 ± 0.405	2.925	0.183	15.98	40	0.001-	++
		Young cows	21	4.834 ± 0.734						
10. Depth of 'sweat' glands (mm.)	A Old cow & young cows	Old cow	16	1.23 ± 0.221	0.13	0.071	1.8	30	0.05+	n.s.
		Young cows	16	1.36 ± 0.178						
	B Calf & young cows	Calf	21	0.80 ± 0.211	0.56	0.057	9.8	40	0.001-	++
		Young cows	21	1.36 ± 0.178						

Notes:- 1. Old cow - 9 years old; Young cows, 3-4 years old;
2. When n = 17, cheek, gluteus, lower foreleg, and lower hind leg are omitted.
3. When n = 16, the above 4 regions and also upper foreleg are omitted.

TABLE XII

COMPARISON OF THE AVERAGE NUMBER OF 'SWEAT' GLANDS PER SQUARE CENTIMETER OF SKIN SURFACE IN DIFFERENT BODY REGIONS OF FIVE 3-4 YEAR OLD COWS.

Body regions	Mean No. of 'sweat' glands/cm^2 skin.	Difference between the front flank and the other regions	Standard error of the difference between means	t	Degrees of freedom	Probability	Significance
Front flank	2149 ± 581						
Forehead	1598 ± 169	551	268	2.06	8	0.05+	n.s.
Neck (lateral)	2398 ± 389	-149	312	0.48	8	0.60+	n.s.
Hind flank	1880 ± 542	269	340	0.79	8	0.40+	n.s.
Back (thoracic)	2265 ± 526	-116	350	0.33	8	0.70+	n.s.
Back (lumbar)	1607 ± 710	542	410	1.32	8	0.20+	n.s.
Back (sacral)	961 ± 446	1188	327	3.63	8	0.01-	++
Gluteus	1292 ± 326	857	292	2.93	8	0.02-	+
Abdomen	1871 ± 544	278	355	0.78	8	0.40+	n.s.
Udder	1462 ± 661	687	406	1.69	8	0.10+	n.s.
Axilla	2444 ± 708	-295	409	0.72	8	0.40+	n.s.
Groin	2144 ± 511	6	346	0.02	8	0.90+	n.s.
Upper foreleg	1937 ± 888	212	474	0.45	7	0.60+	n.s.
Lower foreleg	1000 ± 141	1140	267	4.27	6	0.01-	++
Upper hind leg	2218 ± 181	- 68	271	0.25	7	0.80+	n.s.
Lower hind leg	882 ± 170	1267	270	4.70	6	0.01-	++

TABLE XIII

COMPARISON OF THE AVERAGE LENGTHS OF 'SWEAT' GLANDS IN DIFFERENT BODY REGIONS OF FIVE 3-4 YEAR OLD COWS.

Body Regions	Mean lengths of 'sweat' Glands (mm)	Difference between front flank and other regions (mm)	Standard error of the difference between means	t	Degrees of freedom	Probability	Significance
Front flank	0.650 ± 0.055						
Forehead	0.625 ± 0.114	0.025	0.0565	0.44	8	0.60+	n.s.
Neck (lateral)	0.578 ± 0.063	0.072	0.0374	1.92	8	0.05+	n.s.
Hind flank	0.609 ± 0.063	0.041	0.0374	1.096	8	0.30+	n.s.
Back (thoracic)	0.615 ± 0.038	0.035	0.0315	1.11	8	0.20+	n.s.
Back (lumbar)	0.698 ± 0.077	-0.048	0.0424	1.13	8	0.20+	n.s.
Back (sacral)	0,739 ± 0.075	-0.089	0.0416	2.14	8	0.05+	n.s.
Gluteus	0.638 ± 0.053	0.012	0.0340	0.35	8	0.70+	n.s.
Abdomen	0.624 ± 0.046	0.026	0.0320	0.75	8	0.40+	n.s.
Udder	0.636 ± 0.071	0.014	0.0401	0.35	8	0.70+	n.s.
Axilla	0.651 ± 0.034	-0.001	0;0289	0.03	8	0.90+	n.s.
Groin	0.646 ± 0.074	0.004	0.0424	0.94	8	0.30+	n.s.
Upper foreleg	0.636 ± 0.041	0.014	0.0307	0.46	7	0.60+	n.s.
Lower foreleg	0.791 ± 0.036	-0.041	0.0310	1.32	6	0.20+	n.s.
Upper hindleg	0.703 ± 0.076	-0.053	0.0419	1.26	7	0.30+	n.s.
Lower hind leg	0.788 ± 0.036	-0.138	0.0929	1.49	6	0.10+	n.s.

Table 14

TABLE XIV

COMPARISON OF THE AVERAGE CIRCUMFERENCE OF 'SWEAT' GLANDS IN DIFFERENT BODY REGIONS OF FIVE 3-4 YEAR OLD COWS

Body Regions	Mean circumference of 'sweat' glands (mm.)	Difference between front flank and other regions (mm.)	Standard error of the difference between means	t	Degrees of freedom	Probability	Significance
Front Flank	0.322 ± 0.045						
Forehead	0.279 ± 0.048	0.043	0.030	1.45	8	0.10+	n.s.
Neck (lateral)	0.291 ± 0.035	0.031	0.026	1.19	8	0.20+	n.s.
Hind flank	0.332 ± 0.036	-0.010	0.026	0.38	8	0.60+	n.s.
Back (thoracic)	0.302 ± 0.034	0.010	0.025	0.40	8	0.60+	n.s.
Back (lumbar)	0.361 ± 0.066	-0.039	0.036	1.08	8	0.30+	n.s.
Back (sacral)	0.405 ± 0.100	-0.083	0.049	1.69	8	0.10+	n.s.
Gluteus	0.387 ± 0.043	-0.065	0.026	2.50	8	0.05-	+
Abdomen	0.380 ± 0.102	0.058	0.051	1.14	8	0.30+	n.s.
Udder	0.347 ± 0.071	-0.025	0.038	0.66	8	0.50+	n.s.
Axilla	0.311 ± 0.068	0.011	0.037	0.30	8	0.70+	n.s.
Groin	0.346 ± 0.136	-0.024	0.064	0.38	8	0.70+	n.s.
Upper Foreleg	0.382 ± 0.078	-0.060	0.040	1.50	7	0.10+	n.s.
Lower Foreleg	0.388 ± 0.018	-0.066	0.026	2.54	6	0.05-	+
Upper Hindleg	0.321 ± 0.069	0.001	0.037	0.03	7	0.90+	n.s.
Lower Hindleg	0.407 ± 0.039	-0.085	0.026	3.27	6	0.02-	+

TABLE XV

COMPARISON OF THE AVERAGE AREA OF THE SECRETING SURFACE OF A SINGLE 'SWEAT' GLAND IN DIFFERENT BODY REGIONS OF FIVE 3-4 YEAR OLD COWS.

Body Regions	Mean area of the secreting surface of a single 'sweat' gland (sq.mm.)	Difference between front flank and other regions	Standard error of the difference between means	t	Degrees of freedom	Probability	Significance
Front flank	0.208 ± 0.024						
Forehead	0.173 ± 0.041	0.035	0.0212	1.65	8	0.10+	n.s.
Neck (lateral)	0.168 ± 0.024	0.040	0.015	2.66	8	0.05-	+
Hind flank	0.201 ± 0.017	0.007	0.0132	0.50	8	0.60+	n.s.
Back (thoracic)	0.184 ± 0.016	0.024	0.0129	1.86	8	0.10	n.s.
Back (lumbar)	0.252 ± 0.053	-0.042	0.026	1.61	8	0.10+	n.s.
Back (sacral)	0.297 ± 0.078	-0.089	0.0362	2.46	8	0.05-	+
Gluteus	0.247 ± 0.025	-0.039	0.0142	2.75	8	0.05-	+
Abdomen	0.237 ± 0.070	-0.029	0.0331	0.87	8	0.40+	n.s.
Udder	0.222 ± 0.056	-0.014	0.0269	0.52	8	0.70+	n.s.
Axilla	0.215 ± 0.050	-0.007	0.0248	0.28	8	0.80+	n.s.
Groin	0.236 ± 0.086	-0.028	0.0398	0.70	8	0.50+	n.s.
Upper fore leg	0.232 ± 0.065	-0.024	0.0342	0.70	7	0.50+	n.s.
Lower foreleg	0.308 ± 0.061	-0.100	0.0367	2.72	6	0.05-	+
Upper hind leg	0.226 ± 0.055	-0.018	0.0295	0.59	7	0.50+	n.s.
Lower hind leg	0.320 ± 0.021	-0.112	0.0236	4.75	6	0.01-	++

TABLE XVI

COMPARISON OF THE AVERAGE AREA OF THE SECRETING SURFACE OF 'SWEAT' GLANDS PER SQ.CM. OF SKIN SURFACE IN DIFFERENT BODY REGIONS OF FIVE 3-4 YEAR OLD COWS.

Body Regions	Mean area of the secreting surface of 'sweat' glands per sq.cm. of skin surface (sq.cm.)	Difference between the front flank and other regions (sq.cm.)	Standard error difference between means	t	Degrees of freedom	Probability	Significance
Front flank	4.48 ± 1.131						
Forehead	2.79 ± 0.253	1.69	0.52	3.25	8	0.02-	+
Neck (lateral)	4.02 ± 0.699	0.46	0.59	0.78	8	0.50+	n.s.
Hind flank	3.78 ± 0.972	0.70	0.66	1.06	8	0.30+	n.s.
Back (thoracic)	4.12 ± 0.681	0.36	0.59	0.60	8	0.50+	n.s.
Back (lumbar)	3.89 ± 1.190	0.59	0.73	0.80	8	0.40+	n.s.
Back (sacral)	2.65 ± 0.608	1.83	0.57	3.21	8	0.02-	+
Gluteus	3.18 ± 0.778	1.30	0.61	2.13	8	0.05+	n.s.
Abdomen	4.29 ± 1.020	0.19	0.68	0.28	8	0.70+	n.s.
Udder	3.20 ± 1.620	1.28	0.88	1.45	8	0.10+	n.s.
Axilla	4.80 ± 1.190	-0.32	0.73	0.44	8	0.60+	n.s.
Groin	4.66 ± 1.590	-0.18	0.87	0.21	8	0.80+	n.s.
Upper foreleg	4.64 ± 2.640	-0.16	1.41	0.113	7	0.90+	n.s.
Lower foreleg	3.02 ± 0.185	1.46	0.68	2.40	6	0.05+	n.s.
Upper hind leg	4.96 ± 0.900	0.48	0.68	0.705	7	0.50+	n.s.
Lower hind leg	2.85 ± 0.740	1.63	0.66	2.47	6	0.05-	+

Table 17

TABLE XVII

COMPARISON OF THE AVERAGE CIRCUMFERENCE OF THE CAPILLARY LOOPS IN THE SUB-EPIDERMAL LEVEL OF SKIN IN DIFFERENT BODY REGIONS OF FIVE 3-4 YEAR OLD COWS

Body Regions	Mean circumference of the capillary loops (mm.)	Difference between the front flank and other regions (mm)	Standard error of the difference between the means	t	Degrees of freedom	Probability	Significance
Front flank	0.740 ± 0.069						
Forehead	0.862 ± 0.088	-0.122	0.050	2.44	8	0.05-	n.s.
Neck (lateral)	0.763 ± 0.072	-0.023	0.044	0.52	8	0.90+	n.s.
Hind flank	0.826 ± 0.115	-0.086	0.060	1.43	8	0.20+	n.s.
Back (thoracic)	0.727 ± 0.029	0.013	0.034	0.38	8	0.70+	n.s.
Back (lumbar)	0.860 ± 0.156	-0.120	0.068	1.70	8	0.10+	n.s.
Back (sacral)	1.035 ± 0.089	-0.295	0.051	5.70	8	0.001-	++
Gluteus	0.947 ± 0.109	-0.217	0.058	3.74	8	0.01-	++
Abdomen	0.780 ± 0.076	-0.040	0.046	0.86	8	0.40+	n.s.
Udder	0.937 ± 0.145	-0.197	0.072	2.73	8	0.05-	+
Axilla	0.692 ± 0.072	0.048	0.044	1.09	8	0.30+	n.s.
Groin	0.770 ± 0.047	-0.030	0.037	0.81	8	0.40+	n.s.
Upper Foreleg	0.871 ± 0.124	-0.131	0.064	2.04	7	0.05+	n.s.
Lower Foreleg	1.025 ± 0.171	-0.285	0.082	3.47	6	0.01+	++
Upper Hindleg	0.753 ± 0.134	-0.013	0.068	1.91	7	0.05+	n.s.
Lower Hindleg	1.098 ± 0.018	-0.358	0.032	11.18	6	0.001-	++

Table 18

TABLE XVIII

COMPARISON OF THE AVERAGE DIAMETERS OF CAPILLARIES AT THE SUB-EPIDERMAL LEVEL OF SKIN IN DIFFERENT BODY REGIONS OF FIVE 3-4 YEAR OLD COWS

Body Regions	Mean diameter of the capillary loop in the sub-epidermal level of skin (mm.)	Difference between front flank and other regions	Standard error of the difference between means	t	Degrees of freedom	Probability	Significance
Front Flank	0.045 ± 0.0062						
Forehead	0.043 ± 0.0069	0.002	.0041	0.487	8	0.6+	n.s.
Neck (lateral)	0.042 ± 0.0042	0.003	.0034	0.882	8	0.4+	n.s.
Hind Flank	0.049 ± 0.0044	-0.004	.0034	1.176	8	0.2+	n.s.
Back (thoracic)	0.047 ± 0.0021	-0.002	.0029	0.689	8	0.5+	n.s.
Back (lumbar)	0.047 ± 0.0083	-0.002	.0046	0.434	8	0.6+	n.s.
Back (sacral)	0.052 ± 0.0072	-0.007	.0042	1.66	8	0.8+	n.s.
Gluteus	0.051 ± 0.0070	-0.006	0.0042	1.43	8	0.8+	n.s.
Abdomen	0.047 ± 0.0120	-0.002	0.0060	0.333	8	0.7+	n.s.
Udder	0.053 ± 0.0101	-0.008	0.0053	1.509	8	0.1+	n.s.
Axilla	0.043 ± 0.0025	0.002	0.0030	0.666	8	0.5+	n.s.
Groin	0.037 ± 0.0156	0.008	0.0075	1.066	8	0.3+	n.s.
Upper Foreleg	0.047 ± 0.0104	-0.002	.0054	0.37	7	0.7+	n.s.
Lower Foreleg	0.048 ± 0.0025	-0.003	.0030	1.00	6	0.3+	n.s.
Upper Hindleg	0.046 ± 0.0030	-0.001	.0030	0.33	7	0.7+	n.s.
Lower Hindleg	0.053 ± 0.0136	-0.008	.0067	1.19	6	0.2+	n.s.

TABLE XIX

COMPARISON OF THE AVERAGE AREA OF THE CAPILLARY SURFACE PER SQ. CM. OF SKIN SURFACE IN THE SUB-EPIDERMAL LEVEL OF SKIN OF FIVE 3-4 YEAR OLD COWS

Body Regions	Mean area of capillary surface per sq.cm. skin in the sub-epidermal Level (sq.cm.)	Difference between the front flank and the other regions	Standard error of the difference between the means	t	Degrees of Freedom	Probability	Significance
Front flank	1.107 ± 0.226						
Forehead	0.928 ± 0.066	0.183	0.115	1.580	8	0.1+	n.s.
Neck (lateral)	1.198 ± 0.038	-0.091	0.102	0.892	8	0.3+	n.s.
Hind flank	1.171 ± 0.242	-0.064	0.148	0.432	8	0.6+	n.s.
Back (thoracic)	1.183 ± 0.186	-0.076	0.130	0.584	8	0.5+	n.s.
Back (lumbar)	0.996 ± 0.248	0.111	0.150	0.740	8	0.4+	n.s.
Back (sacral)	0.796 ± 0.305	0.311	0.170	1.820	8	0.1+	n.s.
Gluteus	0.960 ± 0.140	0.147	0.222	0.660	8	0.5+	n.s.
Abdomen	1.048 ± 0.167	0.059	0.126	0.468	8	0.6+	n.s.
Udder	1.055 ± 0.244	0.052	0.148	0.351	8	0.7+	n.s.
Axilla	1.106 ± 0.161	0.001	0.124	0.001	8	0.9+	n.s.
Groin	1.117 ± 0.217	-0.010	0.140	0.007	8	0.9+	n.s.
Upper foreleg	1.232 ± 0.566	-0.125	0.272	0.450	7	0.6+	n.s.
Lower foreleg	0.841 ± 0.191	0.266	0.132	2.010	6	0.05+	n.s.
Upper hindleg	1.225 ± 0.447	-0.118	0.224	0.520	7	0.6+	n.s.
Lower hindleg	0.805 ± 0.207	0.302	0.137	2.200	6	0.05+	n.s.

Table 20

TABLE XX

COMPARISON OF THE AVERAGE THICKNESS OF SKIN
IN DIFFERENT BODY REGIONS OF FIVE 3-4 YEAR OLD COWS

Body Regions	Mean Thickness of Skin (mm.)	Difference between front flank and other regions	Standard error of difference between means	t	Degrees of freedom	Probability	Significance
Front Flank	5.58 ± 0.996						
Forehead	4.68 ± 0.680	0.90	0.536	1.68	8	0.10+	n.s.
Neck (lateral)	4.92 ± 0.686	0.66	0.541	1.22	8	0.20+	n.s.
Hind Flank	5.68 ± 0.924	-0.10	0.603	0.17	8	0.80+	n.s.
Back (thoracic)	5.04 ± 0.554	0.54	0.585	0.92	8	0.30+	n.s.
Back (lumbar)	5.29 ± 0.760	0.29	0.554	0.52	8	0.60+	n.s.
Back (sacral)	5.42 ± 0.989	0.16	0.626	0.26	8	0.80+	n.s.
Gluteus	4.93 ± 0.627	0.65	0.523	1.24	8	0.20+	n.s.
Abdomen	3.39 ± 0.277	2.19	0.456	4.80	8	0.01-	++
Udder	3.39 ± 0.989	1.65	0.626	2.63	8	0.05-	+
Axilla	4.55 ± 0.483	1.03	0.491	2.09	8	0.05+	n.s.
Groin	4.60 ± 0.789	0.98	0.563	1.74	8	0.10+	n.s.
Upper Foreleg	4.25 ± 1.158	1.33	0.679	1.95	7	0.05+	n.s.
Lower Foreleg	4.94 ± 0.849	0.64	0.581	1.10	6	0.30+	n.s.
Upper Hindleg	4.78 ± 0.043	0.80	0.445	1.80	7	0.10+	n.s.
Lower Hindleg	5.84 ± 0.486	-0.26	0.491	0.53	6	0.60+	n.s.

TABLE XXI

COMPARISON OF THE AVERAGE DEPTHS OF 'SWEAT' GLANDS IN DIFFERENT BODY REGIONS OF FIVE 3-4 YEAR OLD COWS

Body Regions	Mean depths of 'sweat' gland (mm.)	Difference between front flank and other regions	Standard error of the difference between means	t	Degrees of freedom	Probability	Significance
Front Flank	1.28 ± 0.177						
Forehead	1.71 ± 0.287	0.43	0;150	2.87	8	0.05-	+
Neck (lateral)	1.31 ± 0.254	0.03	0.138	0.22	8	0.80+	n.s.
Hind flank	1.22 ± 0.202	0.06	0.120	0.50	8	0.60+	n.s.
Back (Thoracic)	1.41 ± 0.092	0.13	0.087	1.49	8	0.10+	n.s.
Back (lumbar)	1.38 ± 0.239	0.10	0.133	0.75	8	0.40+	n.s.
Back (sacral)	1.48 ± 0.269	0.20	0.143	1.40	8	0.10+	n.s.
Gluteus	1.28 ± 0.236	0.00	0.000	0	8	0.90+	n.s.
Abdomen	1.19 ± 0.142	0.09	0.101	0.89	8	0.30+	n.s.
Udder	1.30 ± 0.275	0.02	0.145	0.14	8	0.80+	n.s.
Axilla	1.05 ± 0.175	0.23	0.111	2.07	8	0.05+	n.s.
Groin	1.37 ± 0.079	0.09	0.086	1.05	8	0.30+	n.s.
Upper foreleg	1.29 ± 0.190	0.01	0.116	0.86	7	0.40+	n.s.
Lower foreleg	1.36 ± 0.528	0.08	0.249	0.32	6	0.70+	n.s.
Upper hindleg	1.27 ± 0.330	0.01	0.167	0.60	7	0.50+	n.s.
Lower hindleg	1.42 ± 0.561	0.14	0.263	0.53	6	0.60+	n.s.

TABLE XXII

CORRELATION BETWEEN THE LENGTH OF 'SWEAT' GLANDS AND THE NUMBER OF 'SWEAT' GLANDS PER SQ.CM. OF SKIN SURFACE

Cow	No. of 'sweat' glands per sq.cm. of skin surface			Length of 'sweat' glands (mm.)						Degrees of freedom		Probability	Significance
	Sx	Sx^2	S.S.x.	Sy	Sy^2	S.S.y	Sxy	S.P.	r	n			
II	44.824	105,44,250	9,768,489	14.075	9,635379	0.201775	29,505.144	-537.608	-0.3830	21	19	0.05+	n.s.
III	40.133	104,497,883	3,831,777	9.890	6.186728	0.073472	24,830.149	22.938	+0.0431	16	14	0.10+	n.s.
IV	36.118	69,512,038	7,392,518	13.613	8.886909	0.062444	22,962.043	-451.021	-0.6636	21	19	0.01-	++
V	30.855	54,913,939	4,807,043	11.123	6.549729	0.038091	18,058.147	-5.020	-0.0117	19	17	0.10+	n.s.
VI	34.388	60,715,030	4,403,861	14.328	9.876882	0.101192	25,064.721	-397.720	-0.5956	21	19	0.01-	++
Total	186.318	395,083,140	40,854,640	63.029	41.135627	0.598337	118,420.204	-1410.696	-0.2856	98	96	0.01-	++
I	23,172	33,735,602	2,150,803	12.949	10.064985	0.201656	17,180.088	-470.161	-0.7137	17	15	0.01-	++
Calf	222,454	2,619,663,156	263,197,341	9.767	4.688115	0.145530	99,614.478	-3,847.818	-0.6217	21	19	0.001-	++

Table 23

TABLE XXIII

CORRELATION BETWEEN THE CIRCUMFERENCE AND THE NUMBER OF 'SWEAT' GLANDS PER SQ.CM. SKIN SURFACE

	No. of 'sweat' glands per sq.cm. skin surface			Circumference			Sxy	S.P.	r	N	Degree of freedom	Probability	Significance
Cow	Sx	Sx^2	S.S.x.	Sy(mm)	Sy^2	S.S.y							
II	44,824	105,444,250	9,768,489	7.237	2.550721	0.056713	15,159.126	-288.078	-0.3870	21	19	0.05+	n.s.
III	40,133	104,497,883	3,831,777	4.553	1.314803	0.019190	11,402.762	- 17.585	-0.2051	16	14	0.10+	n.s.
IV	36,118	69,512,038	7,392,518	7.014	2.430534	0.087858	11,869.600	-195.812	-0.2406	21	19	0.10+	n.s.
V	28,713	50,325,775	4,523,754	6.117	2.134103	0.055342	9,500.043	-257.592	-0.5152	18	16	0.05-	+
VI	34,388	60,715,030	4,403,861	7.896	3.129790	0.160894	12,553.195	-376.093	-0.4480	21	19	0.05 -	+
Total	184,176	390,494,976	40,796,018	32.817	11.559951	0.457317	60,484.726	-1825.622	-0.4222	97	95	0.001-	++
I	28,029	39,787,169	2,376,462	7.657	2.839355	0.047467	10,193.122	- 26.785	-0.3012	21	19	0.01+	n.s.
Calf	224,454	2,619,663,156	263,197,341	6.559	2.069573	0.020979	68,801.418	-678.381	-0.2888	21	19	0.01+	n.s.

Table 24

TABLE XXIV

CORRELATION BETWEEN THE CIRCUMFERENCE AND THE LENGTH OF 'SWEAT' GLANDS

Cow	Circumference			Length									
	Sx (mm)	Sx^2	SSx	Sy(mm)	Sy^2	SSy	Sxy	S.P.	N	Degrees of freedom	r.	Probability	Significance
II	7.237	2.550721	0.056713	14.075	9.635379	0.201778	4.878241	0.027728	21	19	0.2596	0.1+	n.s.
III	4.553	1.314803	0.019190	9.893	6.190487	0.073521	2.803721	0.011456	16	14	-0.3050	0.1+	n.s.
IV	7.014	2.430534	0.087858	13.613	8.886909	0.062444	4.578332	0.031600	21	19	0.445	0.05-	+
V	6.117	2.134103	0.055342	10.552	6.223688	0.037871	3.588256	0.002335	18	16	0.052	0.1+	n.s.
VI	7.896	3.129790	0.160894	14.328	9.876882	0.101092	5.418722	0.031394	21	19	0.242	0.1+	n.s.
Total	32.817	11.559951	0.457317	62.461	40.813345	0.592968	21.267272	0.135492	97	95	0.260	0.02-	+
I	6.187	2.287385	0.035681	12.949	10.064985	0.201665	4.701813	-0.010861	17	15	-0.1279	0.1+	n.s.
Calf	6.559	2.069573	0.020979	9.767	4.688135	0.145530	3.072478	0.021918	21	19	0.3968	0.05+	n.s.

Table 25

TABLE XXV

CORRELATION BETWEEN THE NUMBER OF 'SWEAT' GLANDS PER SQ.CM. OF SKIN SURFACE AND THE AREA OF THE SECRETING SURFACE OF A SINGLE 'SWEAT' GLAND.

Cow	No. of 'sweat' glands per sq.cm. of skin surface			Area of the secreting surface of a single 'sweat' gland							Degrees of freedom	Probability	Significance
	Sx	Sx^2	S.S.x	Sy (sq.mm.)	Sy^2	S.S.y	Sxy	S.P.	r	n			
II	44,824	105,440,978	9,765,217	4.877	1.195081	0.062456	9,999.586	-410.254	-0.526	21	19	0.02-	+
III	40,133	104,497,883	3,831,777	2.804	0.499664	0.008263	7,035.175	1.867	0.010	16	14	0.90+	n.s.
IV	36,116	69,503,338	7,390,697	4.579	1.056991	0.058551	7,394.779	-480.229	-0.731	21	19	0.01-	++
V	30,855	54,913,939	4,807,043	3.759	0.771069	0.027381	5,926.892	-177.526	-0.643	19	17	0.01-	++
VI	34,988	62,365,030	4,071,690	5.408	1.494474	0.091785	8,644.847	-365.396	-0.598	21	19	0.01-	++
Total	186,916	396,721,168	40,215,137	21.427	5.017279	0.332419	39,001.279	-1,866.569	-0.509	98	96	0.01-	++
I	21,514	30,986,638	2,058,376	4.428	1.266432	0.040983	5,747.160	-107.000	-0.36	16	14	0.10-	n.s.
Calf	222,460	2,619,780,552	263,187,619	3.074	0.475810	0.025835	31,081.236	-1482.671	-0.386	21	19	0.05+	n.s.

Table 26

TABLE XXVI

CORRELATION BETWEEN THE NUMBER OF 'SWEAT' GLANDS PER SQ.CM. OF SKIN SURFACE AND THE AREA OF THE SECRETING SURFACE OF 'SWEAT' GLANDS PER SQ.CM. OF SKIN SURFACE

Cow	No. of 'sweat' glands per sq.cm. of skin surface			Area of the secreting surface of 'sweat' glands per sq.cm. of skin surface (sq.cm.)							Degree of free-dom	Prob-abil-ity	Signi-ficance
	Sx	Sx^2	S.S.x	Sy	Sy^2	S.S.y	Sxy	S.P.	r	n			
II	44,824	105,444,250	9,768,489	100.00	526.5484	50.3579	232,168.66	18,721.06	+0.8440	21	19	0.001-	++
III	40,133	104,497,883	3,831,777	70.35	325.5515	16.2313	183,189.41	6,729.63	+0.8533	16	14	0.001-	++
IV	36,118	69,512,038	7,392,518	74.06	276.1210	14.9361	135,433.98	8,057.83	+0.7683	21	19	0.001-	++
V	30,855	54,913,939	4,807,043	59.26	199.1188	14.2900	103,213.76	6,978.64	+0.8419	19	17	0.001-	++
VI	34,388	60,715,030	4,403,861	84.52	364.5128	24.3399	143.921.99	5,518.48	+0.5335	21	19	0.02-	+
Total	186,318	395,083,140	40,854,640	388.19	1691.8525	154.1845	797,927.80	59,899.40	+0.7547	98	96	0.001-	++
I	23,172	33,735,602	2,150,803	62.31	237.9785	9.5940	88,545.57	3,613.37	+0.7961	17	15	0.001-	++
Calf	222,454	2,619,663,156	263,197,341	31.11	50.4695	4.3823	354,350.63	24,800.92	+0.7313	21	19	0.001-	++

Table 27

TABLE XXVII

CORRELATION BETWEEN THE NUMBER OF HAIRS PER SQ.CM. OF SKIN SURFACE AND THE CIRCUMFERENCE OF CAPILLARY LOOPS AT THE SUB-EPIDERMAL LEVEL OF COW SKIN.

Cow	No. of hairs per sq.cm. of skin surface			Circumference of capillary loops (mm.)								
	Sx	Sx^2	S.S.x.	Sy	Sy^2	S.S.y	Sxy	S.P.	r	n	Degrees of freedom	Probability	Significance
II	44,828	105,444,250	9,768,489	15.865	12.375965	0.390335	32,500.123	-1363.342	-0.8563	21	19	0.001-	++
III	40,133	104,497,883	3,831,777	11.574	8.501772	0.129430	28,411.517	- 619.692	-0.8802	16	14	0.001-	++
IV	36,118	69,512,038	7,392,518	17.913	15.669895	0.390106	29,458.079	-1350.575	-0.7599	21	19	0.001-	++
V	30,855	54,913,939	4,807,043	16.306	14.332418	0.338437	25,308.758	-1171.328	-0.9173	19	17	0.001-	++
VI	34,388	60,715,030	4,403,861	18.338	16.353794	0.340354	28,962.288	-1068.528	-0.8725	21	19	0.001-	++
Total	186,318	395,083,140	40,854,600	79.996	67.233844	1.934252	144,640.765	-7447.955	-0.8380	98	96	0.001-	++
I	28,029	39,787,169	2,376,462	19.214	17.993310	0.413415	25,202.937	442.263	-0.4413	21	19	0.05-	+
Calf	222,454	2,619,663,156	263,197,341	8.595	3.576679	0.058868	89,125.443	1,921.801	-0.4881	21	19	0.05-	+

Table 28

TABLE XXVIII

CORRELATION BETWEEN THE CIRCUMFERENCE OF THE CAPILLARY LOOPS AND THE DIAMETER OF CAPILLARIES AT THE SUB-EPIDERMAL LEVEL OF COW SKIN

Cow	Circumference of the capillary loops (mm.)			Diameter of the capillaries (mm.)							Degrees of freedom	Probability	Significance
	Sx	Sx^2	S.S.x.	Sy	Sy^2	S.S.y	Sxy	S.P.	r	n			
II	15.865	11.985630	0.390335	0.899	0.038739	.000253	0.683788	0.004615	+0.4642	21	19	0.05-	+
III	11.574	8.372342	0.129430	0.724	0.033056	0.000296	0.524861	0.001137	+0.1837	16	14	0.10+	n.s.
IV	17.913	15.279789	0.390106	1.106	0.061442	0.003193	0.962462	0.019044	+0.5386	21	19	0.02-	+
V	16.306	14.332418	0.338437	0.814	0.035152	0.000279	0.704620	0.003879	+0.3992	19	17	0.05+	n.s.
VI	18.338	16.353794	0.058868	1.049	0.052827	0.000169	0.913090	0.001078	+0.2726	21	19	0.10+	n.s.
Total	79.996	66.323973	1.024481	4.592	0.221216	0.006047	3.788821	0.40437	+0.5138	98	96	0.001-	++
I	19.414	17.993310	0.413415	0.989	0.047093	.000516	0.908250	0.00336	+0.2303	21	19	0.10+	n.s.
Calf	8.595	3.576679	0.058868	0.671	0.021609	.000169	0.275709	0.001078	+0.3417	21	19	0.10+	n.s.

TABLE XXIX

CORRELATION BETWEEN THE AREA OF CAPILLARY SURFACE PER SQ.CM. OF SKIN SURFACE AND THE NUMBER OF HAIRS PER SQ.CM. OF SKIN SURFACE.

Cow	Area of capillary surface per sq.cm. of skin surface (sq.cm.)			No. of hairs per sq.cm. of skin surface.								
	Sx	Sx^2	S.S.x	Sy	Sy^2	S.S.y.	Sxy	S.P.	r	n	Degrees of freedom	Probability	Significance
II	21.729	24.183351	1.700041	44,824	105,444,250	9,768,489	49,689.593	3,309.56	+0.8124	21	19	0.001-	++
III	20.110	25.614750	0.338994	40,133	104,497,883	3,851,777	51,126.097	683.933	+0.5999	16	14	0.02-	+
IV	23.412	27.430600	1.329565	36,118	69,512,038	7,392,518	41,152.109	885.699	+0.2825	21	19	0.10+	n.s.
V	16.929	15.680630	0.596892	30,855	54,913,939	4,807,043	28,857.062	1,365.257	+0.8074	19	21	0.001-	++
VI	22.582	25.108510	0.825333	34,388	60,715,030	4,403,861	38,594.090	1,616.530	+0.8486	21	19	0.001-	++
Total	104.762	118.017842	6.027342	186,318	395,083,140	40,854,640	209,418.951	10,245.051	+0.6532	97	95	0.001-	++
I	18.538	17.243686	0.887872	28,029	39,787,169	2,376,462	25,657.536	914.603	+0.6295	21	19	0.01-	++
Calf	21.729	24.183351	1.700041	44,824	105,444,250	9,786,489	512,695.828	44,027.622	+0.9006	21	19	0.001-	++

Table 30

TABLE XXX

CORRELATION BETWEEN THE DEPTH OF 'SWEAT' GLANDS AND THE THICKNESS OF SKIN.

Cow	Thickness of Skin			Depth of 'sweat' glands			Sxy	S.P.	r.	n.	Degrees of freedom	Probability	Significance
	Sx (mm)	Sx2	S.S.x.	Sy (mm)	Sy2	S.S.y							
II	88.85	389.9899	14.0698	26.84	35.5744	1.2703	114.9869	1.4280	0.3375	21	19	0.05+	n.s.
III	74.86	388.8070	15.2057	22.33	34.0887	0.8468	113.5612	2.1196	0.5901	15	13	0.02-	+
IV	95.52	444.4218	9.9423	27.44	38.0870	2.2321	126.5430	1.7302	0.3672	21	19	0.05+	n.s.
V	101.33	553.4421	13.0332	28.58	43.9852	0.9949	153.3885	0.9668	0.2681	19	17	0.10+	n.s.
VI	110.66	604.9892	21.8637	33.09	53.3055	1.1651	176.5305	2.1620	0.4281	21	19	0.05+	n.s.
Total	471.22	2381.6500	92.4924	138.28	205.0408	7.9134	685.0100	13.2543	0.4899	97	87	0.01-	+
I	74.13	354.5087	11.0551	19.78	25.1566	0.7036	92.6247	0.9815	0.3519	16	14	0.10+	n.s.
Calf	40.10	80.0106	3.4387	16.54	13.5304	0.5032	31.9548	0.3713	0.2823	21	19	0.10+	n.s.

TABLE XXXI

CORRELATION BETWEEN THE THICKNESS OF SKIN AND THE NUMBER OF 'SWEAT' GLANDS PER SQ.CM. OF SKIN SURFACE

Cow	Thickness of skin (mm.)			No. of 'sweat' glands per sq.cm. of skin surface							Degrees of freedom	Probability	Significance
	Sx	Sx^2	S.S.x	Sy	Sy^2	S.S.y	Sxy	S.P.	r	n			
II	88.85	389.9899	14.0698	44.824	105,444,250	9,768,489	186,983.78	-2,664.43	-0.2276	21	19	0.10+	n.s.
III	74.86	388.8070	15.2057	36,802	95,142,322	4,849,842	184,577.20	910.72	+0.1061	16	14	0.10+	n.s.
IV	95.32	444.4218	9.9423	36,118	62,119,520	7,392,518	165,573.35	1,288.05	+0.1502	21	19	0.10+	n.s.
V	101.33	553.4421	13.0332	30.855	54,913,939	4,807,043	164,008.70	-545.89	-0.0689	19	17	0.10+	n.s.
VI	110.66	604.9892	21.8637	34,388	60,715,030	4,403,861	179,374.30	-1,834.06	-0.1869	21	19	0.10+	n.s.
Total	471.22	2381.6500	92.4930	182,987	385,727,570	40,529,279	880,517.05	-8,422.45	-0.4349	97	95	0.001-	h.s.
I	74.13	354.5089	11.0551	21,514	30,986,638	2,058,376	98,727.67	-947.38	-0.1988	16	14	0.10+	n.s.
Calf	40.10	80.0106	3.4387	222,454	2,356,465,815	263,193,341	435,436.00	+10,654.79	+0.3542	21	19	0.05+	n.s.

TABLE XXXII

CORRELATION BETWEEN THE THICKNESS OF SKIN AND THE AREA OF SECRETING SURFACE OF 'SWEAT' GLANDS PER SQ.CM. OF SKIN SURFACE.

Cow	Thickness of skin (mm.)			Area of secreting surface of 'sweat' glands per sq.cm. of skin surface (sq.cm.)							Degrees of freedom	Probability	Significance
	Sx	Sx^2	S.S.x.	Sy	Sy^2	S.S.y	Sxy	S.P.	r	n			
II	88.85	389.9899	14.0698	100.00	526.5484	50.3579	422.0136	-1.0816	-0.0406	21	19	0.10+	n.s.
III	74.86	388.8070	15.2057	65.15	298.5115	15.5433	330.9949	5.8530	+0.3810	15	13	0.10+	n.s.
IV	95.52	444.4218	9.9423	74.06	276.1210	14.9361	335.3964	-1.4708	-0.1209	21	19	0.10+	n.s.
V	101.33	553.4421	13.0332	59.26	199.1188	14.2900	319.1237	3.0808	+0.2259	19	17	0.10+	n.s.
VI	110.66	604.9892	21.8637	84.52	364.5128	24.3399	437.2913	-8.0889	-0.3507	21	19	0.10+	n.s.
Total	471.22	2381.6500	92.4930	382.99	1664.8125	152.6345	1844.8199	-15.7211	-0.1324	97	95	0.10+	n.s.
I	74.13	354.5087	11.0551	57.81	217.7285	8.8537	266.7527	-1.0883	-0.1100	16	14	0.10+	n.s.
Calf	40.10	80.0106	3.4387	31.11	50.4695	4.3822	59.8808	0.4755	0.1324	21	19	0.10+	n.s.

Table 33

TABLE XXXIII

CORRELATION BETWEEN THE AREA OF CAPILLARY SURFACE PER SQ.CM. OF SKIN SURFACE AND THE THICKNESS OF SKIN

Cow	Area of capillary surface per sq.cm. of skin surface (sq.cm.)			Thickness of skin (mm.)							Degrees of freedom	Probability	Significance
	Sx	Sx^2	S. S.x.	Sy	Sy^2	S.S.y	Sxy	S.P.	r.	n			
II	21.729	24.183351	1.700041	88.85	389.9899	14.0698	90.33929	-1.59507	-0.3263	21	19	0.10+	n.s.
III	18.838	23.996766	0.338750	74.86	388.8070	15.2057	94.64359	+0.02941	+0.0130	15	13	0.10+	n.s.
IV	23.412	27.430600	1.329565	95.52	444.4218	9.9423	106.55518	+0.06403	+0.0176	21	19	0.10+	n.s.
V	16.929	15.680631	0.596892	101.33	553.4421	13.0333	90.99405	+0.70902	+0.2542	19	17	0.10+	n.s.
VI°	22.582	25.108510	0.825333	110.66	604.9892	21.8637	118.93871	-0.05768	-0.0136	21	19	0.10+	n.s.
Total	103.490	116.399858	5.985631	471.22	2381.6500	92.4924	501.47082	-1.37719	-0.0543	97	95	0.10+	n.s.
I	14.272	13.358016	0.627392	74.13	354.5087	11.0551	64.77318	-1.35078	-0.5127	16	14	0.10+	n.s.
Calf	44.243	102.290251	9.078677	40.10	80.0106	3.4387	85.60889	+1.12583	+0.2016	21	19	0.10+	n.s.

Table 34

TABLE XXXIV

CORRELATION BETWEEN THE DEPTH AND THE LENGTH OF 'SWEAT' GLANDS

Cow	Depth of 'sweat' glands (mm.)			Length of 'sweat' glands (mm)							Degrees of freedom	Probability	Significance
	Sx	Sx^2	S.S.x	Sy	Sy^2	S.S.y	Sxy	S.P.	r	n			
II	26.84	35.5744	1.2703	14.075	9.635379	0.201778	18.23734	0.24815	+0.1551	21	19	0.10+	n.s.
III	22.33	34.0887	0.8468	9.288	5.821912	0.073259	13.88817	0.06441	+0.0818	15	13	0.10+	n.s.
IV	27.44	38.0870	2.2321	13.613	8.886909	0.062444	17.97908	0.19143	+0.5134	21	19	0.02-	+
V	28.58	43.9852	0.9949	11.123	6.549729	0.038091	16.69579	-0.03554	-0.1825	19	17	0.10+	n.s.
VI	33.09	53.3055	1.1651	14.328	9.876882	0.101192	22.76138	0.18455	+0.5372	21	19	0.02-	+
Total	138.28	205.0408	7.9134	62.425	40.770811	0.596811	89.56176	0.57076	+0.2627	97	95	0.01-	++
I	19.78	25.1566	0.7036	12.173	9.462809	0.201438	15.29473	0.24586	0.06532	16	14	0.10+	n.s.
Calf	16.54	13.5304	0.5032	9.767	4.688115	0.145530	7.73846	0.04578	0.1692	21	19	0.10+	n.s.

TABLE XXXV (A)

SUMMARY OF THE MEASUREMENTS ON COW I

Body Regions	No. of 'sweat' glands per sq.cm. of skin surface (N=10)					Length of 'sweat' glands (mm.) (N = 30)					Circumference of 'sweat' glands (mm.) (N = 30)				
	Mean	Stand. Dev.	Stand. err.	Coef. of Var (%)	Range	Mean	Stand. Dev.	Stand. err.	Coef. of Var (%)	Range	Mean	Stand Dev.	Stand err	Coef. of Var (%)	Range
Forehead	903	86	27	10	736-998	1.068	0.082	0.014	7	0.650-1.875	0.285	0.043	0.0078	15	0.165-0.345
Cheek	1470	154	31	11	1353-1565	-	-	-	-	-	0.353	0.055	0.0100	16	0.242-0.496
Neck (dorsal)	1827	98	31	5	1692-1979	0.670	0.097	0.017	14	0.500-0.895	0.402	0.101	0.0180	25	0.223-0.595
Neck (lateral)	1776	167	53	9	1539-2013	0.739	0.097	0.017	13	0.575-0.900	0.407	0.072	0.0131	18	0.240-0.548
Neck (ventral)	1808	118	37	7	1683-2064	0.624	0.090	0.016	14	0.450-0.787	0.340	0.046	0.0083	13	0.200-0.550
Back (thoracic)	1101	63	20	6	989-1201	0.747	0.044	0.008	5	0.494-0.938	0.357	0.076	0.0138	21	0.250-0.588
Back (lumbar)	1087	50	16	5	1006-1192	0.847	0.046	0.008	5	0.670-1.150	0.440	0.122	0.0220	28	0.236-0.655
Back (sacral)	665	35	11	5	617-719	0.861	0.051	0.009	5	0.605-1.225	0.459	0.034	0.0062	7	0.263-0.743
Front Flank	1743	122	39	7	1548-2013	0.656	0.042	0.007	6	0.490-1.040	0.344	0.021	0.0038	6	0.250-0.540
Hind Flank	1185	121	38	10	989-1412	0.680	0.138	0.025	20	0.500-1.075	0.415	0.032	0.0058	8	0.245-0.700
Shoulder	1821	142	45	8	1666-2131	0.633	0.008	0.001	1	0.500-0.775	0.326	0.069	0.0125	21	0.200-0.453
Gluteus	1165	114	36	10	930-1370	-	-	-	-	-	0.402	0.043	0.0078	11	0.240-0.695
Breast	1421	115	36	8	1218-1582	0.690	0.102	0.018	14	0.512-0.912	0.376	0.070	0.0127	19	0.226-0.500
Abdomen	1327	125	40	9	1159-1556	0.751	0.108	0.019	14	0.550-0.987	0.356	0.070	0.0127	20	0.200-0.488
Udder	969	97	31	10	592-862	0.828	0.154	0.028	18	0.620-1.100	0.345	0.032	0.0058	9	0.213-0.660
Axilla	1117	83	26	7	981-1209	0.757	0.088	0.016	11	0.525-0.937	0.353	0.070	0.0127	20	0.213-0.560
Groin	1503	115	40	8	1319-1734	0.729	0.134	0.024	18	0.500-1.087	0.298	0.082	0.0149	28	0.160-0.505
Upper Foreleg	1658	113	36	7	1522-1861	0.776	0.072	0.013	9	0.637-0.950	0.351	0.093	0.0169	26	0.195-0.643
Lower Foreleg	1291	180	57	14	1167-1675	-	-	-	-	-	0.404	0.069	0.0125	17	0.278-0.568
Upper Hindleg	1261	150	48	12	939-1446	0.893	0.111	0.020	12	0.720-1.140	0.331	0.059	0.0107	18	0.240-0.460
Lower Hindleg	931	92	29	10	786-1057	-	-	-	-	-	0.331	0.063	0.0114	19	0.238-0.502

TABLE XXXV (B)

SUMMARY OF THE MEASUREMENTS ON COW I

Body Regions	Circumference of Capillary Loops at the Sub-Epidermal Level of Skin (mm.) (N = 30)					Diameter of Capillaries at the Sub-Epidermal Level of Skin (mm.) (N = 30)				
	Mean	Stand. Dev.	Stand. err.	Coef. of Var. (%)	Range	Mean	Stand. Dev.	Stand. err.	Coef. of Var. (%)	Range
Forehead	1.275	0.164	0.051	13	.925-1.500	0.048	0.015	0.0027	31	0.03-0.10
Cheek	0.920	0.086	0.027	9	.775-1.050	0.055	0.013	0.0023	23	0.03-0.08
Neck (dorsal)	0.878	0.086	0.027	10	.650-1.075	0.046	0.009	0.0017	20	0.03-0.08
Neck (lateral)	0.985	0.082	0.026	8	.850-1.075	0.045	0.009	0.0016	20	0.03-0.06
Neck (ventral)	0.843	0.212	0.067	25	.625-1.300	0.042	0.011	0.0020	26	0.02-0.07
Back (thoracic)	0.965	0.152	0.048	15	.725-1.150	0.042	0.009	0.0017	22	0.02-0.06
Back (lumbar)	0.940	0.136	0.043	14	.700-1.100	0.049	0.011	0.0020	22	0.03-0.07
Back (sacral)	1.052	0.162	0.051	15	.800-1.300	0.047	0.017	0.0031	36	0.02-0.08
Front Flank	0.748	0.103	0.032	13	.600-.900	0.042	0.011	0.0020	26	0.02-0.08
Hind Flank	0.978	0.404	0.127	41	.800-1.225	0.053	0.013	0.0023	24	0.03-0.09
Shoulder	0.673	0.120	0.037	17	.500- .925	0.044	0.013	0.0023	29	0.02-0.09
Gluteus	0.975	0.092	0.029	9	.825-1.100	0.058	0.013	0.0023	22	0.04-0.09
Breast	1.010	0.097	0.031	10	.900-1.175	0.049	0.009	0.0017	19	0.03-0.07
Abdomen	1.100	0.077	0.024	7	.775-1.000	0.046	0.009	0.0016	19	0.03-0.06
Udder	0.873	0.141	0.044	16	.950-1.325	0.053	0.011	0.0020	20	0.04-0.09
Axilla	0.668	0.065	0.021	10	.575- .775	0.052	0.016	0.0029	30	0.03-0.08
Groin	0.958	0.132	0.041	13	.958- .132	0.047	0.011	0.0020	23	0.03-0.08
Upper Foreleg	0.835	0.151	0.047	18	.835- .151	0.038	0.009	0.0016	23	0.03-0.06
Lower Foreleg	0.735	0.056	0.018	8	.675- .800	0.040	0.013	0.0023	32	0.02-0.08
Upper Hindleg	0.833	0.098	0.031	12	.650- .975	0.048	0.017	0.0031	35	0.03-0.09
Lower Hindleg	0.970	0.093	0.029	10	.825-1.100	0.045	0.013	0.0023	28	0.03-0.09

TABLE XXXV (C)

SUMMARY OF THE MEASUREMENTS ON COW I

Body Regions	Thickness of Skin (mm.) (N = 10)					Depth of 'sweat' Glands (mm.) (N = 10)				
	Mean	Stand. Dev.	Stand. err.	Coef. of Var.(%)	Range	Mean	Stand. Dev.	Stand. err.	Coef. of Var.(%)	Range
Forehead	4.39	0.534	0.168	12	3.6 - 5.1	1.79	0.414	0.131	23	1.1 - 2.4
Cheek	-	-	-	-	-	-	-	-	-	-
Neck (dorsal)	4.66	0.321	0.101	7	4.0 - 5.1	1.26	0.189	0.059	15	1.0 - 1.5
Neck (lateral)	4.72	0.308	0.097	6	4.4 - 5.2	1.11	0.151	0.047	14	0.9 - 1.4
Neck (ventral)	5.02	0.342	0.108	7	4.4 - 5.5	1.21	0.151	0.047	12	1.0 - 1.5
Back (thoracic)	5.89	0.507	0.160	9	4.9 - 6.6	1.63	0.238	0.075	15	1.1 - 1.8
Back (lumbar)	5.07	0.302	0.095	6	4.5 - 5.4	1.12	0.089	0.028	8	0.9 - 1.2
Back (sacral)	6.64	0.548	0.173	8	5.8 - 7.2	1.40	0.122	0.038	9	1.2 - 1.6
Front Flank	4.82	0.205	0.064	4	4.5 - 5.1	1.03	0.063	0.020	6	0.9 - 1.1
Hind Flank	4.68	0.155	0.049	3	4.4 - 4.8	0.98	0.063	0.020	6	0.9 - 1.1
Shoulder	5.19	0.438	0.138	8	4.6 - 5.9	1.18	0.122	0.038	10	1.0 - 1.4
Gluteus	-	-	-	-	-	-	-	-	-	-
Breast	3.48	0.148	0.046	4	3.2 - 3.7	1.07	0.094	0.030	9	0.9 - 1.2
Abdomen	3.32	0.210	0.066	6	3.0 - 3.6	1.07	0.130	0.041	12	0.9 - 1.3
Udder	3.87	0.266	0.084	7	3.5 - 4.2	1.15	0.083	0.026	7	1.0 - 1.3
Axilla	4.55	0.228	0.072	5	4.2 - 4.9	1.25	0.181	0.057	14	1.0 - 1.5
Groin	3.82	0.297	0.093	8	3.4 - 4.4	1.20	0.167	0.052	14	0.9 - 1.5
Upper Foreleg	-	-	-	-	-	-	-	-	-	-
Lower Foreleg	-	-	-	-	-	-	-	-	-	-
Upper Hindleg	4.01	0.351	0.111	9	3.6 - 4.8	1.33	0.114	0.036	9	1.2 - 1.5
Lower Hindleg	-	-	-	-	-	-	-	-	-	-

TABLE XXXVI (A)

SUMMARY OF THE MEASUREMENTS ON COW II

Body Regions	No. of 'sweat' glands per sq. cm. of skin surface (N = 10)					Length of 'sweat' glands (mm.) (N = 30)					Circumference of 'sweat' glands (mm.) (N = 30)				
	Mean	Stand. Dev.	Stand. err.	Coef. of Var (%)	Range	Mean	Stand. Dev.	Stand. err.	Coef. of Var. (%)	Range	Mean	Stand. Dev.	Stand. err.	Coef. of Var. (%)	Range
Forehead	1669	74	23	4	1599-1785	0.760	0.033	0.006	4	0.645-0.975	0.315	0.081	0.0147	26	0.185-0.450
Cheek	2019	125	39	6	1810-2208	0.504	0.052	0.009	10	0.425-0.600	0.225	0.053	0.0096	24	0.153-0.290
Neck (dorsal)	2287	158	50	7	2013-2453	0.647	0.082	0.014	12	0.525-0.800	0.307	0.056	0.0102	18	0.223-0.440
Neck (lateral)	2128	61	19	3	2030-2224	0.630	0.036	0.006	5	0.425-1.019	0.315	0.050	0.0091	16	0.212-0.400
Neck (ventral)	3307	180	56	5	3087-3544	0.692	0.039	0.007	5	0.525-1.075	0.352	0.061	0.0111	17	0.228-0.486
Back (thoracic)	2805	182	58	7	2580-3214	0.565	0.037	0.006	6	0.350-0.800	0.317	0.063	0.0114	20	0.170-0.400
Back (lumbar)	1574	101	32	6	1497-1776	0.657	0.074	0.013	11	0.475-0.880	0.415	0.064	0.0116	15	0.288-0.560
Back (sacral)	730	57	18	8	617- 812	0.788	0.117	0.021	14	0.600-1.010	0.498	0.034	0.0062	7	0.345-0.748
Front Flank	2510	280	89	12	2258-3257	0.600	0.041	0.007	6	0.275-0.825	0.332	0.068	0.0124	20	0.183-0.500
Hind Flank	2161	147	46	7	1886-2377	0.569	0.034	0.006	5	0.400-0.800	0.358	0.084	0.0153	23	0.188-0.560
Shoulder	2067	120	37	6		0.504	0.032	0.005	6	0.350-0.700	0.351	0.073	0.0133	21	0.200-0.500
Gluteus	1642	73	23	4	1573-1793	0.710	0.034	0.006	4	0.587-1.062	0.375	0.066	0.0120	18	0.240-0.508
Breast	2573	212	79	8	2174-2817	0.514	0.032	0.005	6	0.250-0.750	0.355	0.075	0.0136	21	0.218-0.460
Abdomen	1913	238	75	12	1675-2089	0.681	0.040	0.007	5	0.506-1.044	0.369	0.033	0.0060	9	0.260-0.473
Udder	2389	208	65	9	2140-2681	0.741	0.036	0.006	4	0.550-1.085	0.331	0.065	0.0118	20	0.200-0.484
Axilla	2977	138	43	5	2766-3155	0.693	0.058	0.010	8	0.500-1.138	0.314	0.089	0.0162	28	0.198-0.482
Groin	2651	192	60	7	2174-2893	0.776	0.199	0.036	25	0.325-1.225	0.312	0.049	0.0089	16	0.240-0.426
Upper Foreleg	3128	135	42	4	3020-3333	0.648	0.197	0.035	30	0.544-0.862	0.397	0.094	0.0171	24	0.173-0.588
Lower Foreleg	1146	93	29	8	998-1167	0.758	0.138	0.025	18	0.588-1.150	0.355	0.073	0.0133	22	0.203-0.496
Upper Hindleg	2329	94	30	4	2191-2470	0.808	0.242	0.044	29	0.610-1.010	0.296	0.059	0.0107	20	0.178-0.436
Lower Hindleg	819	105	33	13	600-955	0.830	0.172	0.031	20	0.550-1.210	0.368	0.051	0.0093	14	0.290-0.470

TABLE XXXVI (B)

SUMMARY OF THE MEASUREMENTS ON COW II

Body Regions	Circumference of capillary loops at the sub-epidermal level of skin (mm.) (N = 30)					Diameter of capillaries at the sub-epidermal level of skin (mm.) (N = 30)				
	Mean	Stand. Dev.	Stand. err.	Coef. of Var.(%)	Range	Mean	Stand. Dev.	Stand. err.	Coef. of Var.(%)	Range
Forehead	0.730	0.069	0.023	9	.625 - .850	0.049	0.024	0.0045	48	0.02 - 0.12
Cheek	0.733	0.049	0.016	7	.650 - .800	0.041	0.016	0.0029	39	0.02 - 0.09
Neck (dorsal)	0.730	0.102	0.032	13	.600 - .975	0.047	0.015	0.0027	31	0.03 - 0.08
Neck (lateral)	0.820	0.145	0.045	17	.600 -1.050	0.044	0.011	0.0020	25	0.02 - 0.07
Neck (ventral)	0.625	0.087	0.028	14	.450 - .800	0.042	0.014	0.0025	33	0.02 - 0.08
Back (thoracic)	0.598	0.089	0.028	15	.475 - .800	0.039	0.016	0.0029	41	0.02 - 0.08
Back (lumbar)	0.735	0.077	0.024	10	.600 - .850	0.044	0.013	0.0023	29	0.02 - 0.07
Back (sacral)	1.133	0.098	0.056	9	1.050 -1.350	0.051	0.017	0.0031	33	0.03 - 0.10
Front Flank	0.685	0.077	0.044	11	.550 - .800	0.038	0.013	0.0023	34	0.02 - 0.07
Hind Flank	0.685	0.114	0.006	16	.550 - .875	0.044	0.012	0.0021	27	0.02 - 0.08
Shoulder	0.600	0.055	0.003	9	.525 - .700	0.042	0.009	0.0016	21	0.03 - 0.06
Gluteus	0.833	0.181	0.010	21	.675 -1.250	0.045	0.014	0.0025	31	0.03 - 0.09
Breast	0.655	0.084	0.005	13	.575 - .825	0.037	0.011	0.0020	29	0.02 - 0.06
Abdomen	0.730	0.050	0.029	7	.650 - .800	0.045	0.011	0.0020	24	0.03 - 0.07
Udder	0.723	0.087	0.005	12	.600 - .900	0.044	0.012	0.0021	27	0.02 - 0.07
Axilla	0.628	0.055	0.017	9	.525 - .700	0.038	0.014	0.0025	36	0.02 - 0.09
Groin	0.738	0.066	0.004	9	.600 - .800	0.044	0.009	0.0016	20	0.03 - 0.06
Upper Foreleg	0.888	0.071	0.004	8	.750 - .975	0.043	0.013	0.0023	30	0.02 - 0.07
Lower Foreleg	0.828	0.038	0.002	5	.750 - .850	0.040	0.009	0.0016	23	0.03 - 0.08
Upper Hindleg	0.690	0.088	0.005	13	.525 - .800	0.041	0.008	0.0015	20	0.03 - 0.06
Lower Hindleg	1.078	0.059	0.003	5	1.000 -1.200	0.041	0.012	0.0021	29	0.03 - 0.08

TABLE XXXVI (C)

SUMMARY OF THE MEASUREMENTS ON COW II

Body Regions	Thickness of skin (mm.) (N = 10)					Depth of 'sweat' glands (mm.) (N = 10)				
	Mean	Stand. Dev.	Stand. err.	Coef. of Var. (%)	Range	Mean	Stand. Dev.	Stand. err.	Coef. of Var. (%)	Range
Forehead	4.55	0.205	0.064	5	4.2 - 4.9	2.06	0.221	0.069	11	1.7 - 2.4
Cheek	2.20	0.188	0.059	9	1.9 - 2.5	1.13	0.098	0.031	9	1.0 - 1.3
Neck (dorsal)	4.50	0.122	0.038	3	4.3 - 4.6	1.33	0.098	0.031	7	1.2 - 1.4
Neck (lateral)	3.85	0.212	0.067	6	3.5 - 4.1	1.05	0.126	0.039	12	0.8 - 1.2
Neck (ventral)	4.66	0.344	0.108	7	4.1 - 5.1	1.19	0.109	0.034	9	1.6 - 1.3
Back (thorax)	4.76	0.141	0.044	3	4.5 - 4.9	1.25	0.094	0.030	8	1.1 - 1.4
Back (lumbar)	4.80	0.226	0.071	5	4.2 - 5.0	1.22	0.100	0.031	8	1.0 - 1.3
Back (sacral)	4.52	0.155	0.049	3	4.3 - 4.7	1.15	0.083	0.026	7	1.0 - 1.3
Front Flank	4.21	0.241	0.076	6	3.9 - 4.4	1.07	0.094	0.030	9	0.9 - 1.2
Hind Flank	5.08	0.105	0.033	2	4.9 - 5.2	1.16	0.044	0.014	4	1.1 - 1.2
Shoulder	4.52	0.114	0.036	3	4.4 - 4.7	1.15	0.070	0.022	6	1.0 - 1.2
Gluteus	4.84	0.109	0.034	2	4.6 - 5.0	1.31	0.074	0.023	6	1.2 - 1.4
Breast	3.08	0.130	0.041	4	2.8 - 3.2	1.01	0.074	0.023	7	0.9 - 1.1
Abdomen	2.97	0.134	0.042	5	2.8 - 3.2	1.04	0.054	0.017	5	1.0 - 1.1
Udder	3.31	0.272	0.086	8	2.9 - 3.6	1.20	0.126	0.039	10	1.0 - 1.3
Axilla	4.78	0.130	0.041	3	4.5 - 5.0	1.44	0.081	0.026	6	1.3 - 1.5
Groin	4.65	0.152	0.048	3	4.3 - 4.8	1.48	0.014	0.004	1	1.3 - 1.8
Upper Foreleg	3.01	0.071	0.022	2	2.9 - 3.1	1.50	0.044	0.014	3	1.4 - 1.6
Lower Foreleg	4.32	0.089	0.028	2	4.2 - 4.5	1.00	0.081	0.026	8	0.9 - 1.2
Upper Hindleg	4.76	0.105	0.033	2	4.5 - 4.9	1.59	0.120	0.037	8	1.4 - 1.8
Lower Hindleg	5.48	0.277	0.087	5	4.8 - 5.3	1.51	0.110	0.034	7	1.4 - 1.7

TABLE XXXVII (A)

SUMMARY OF THE MEASUREMENTS ON COW III

Body Regions	No. of 'sweat' glands per sq.cm. of skin surface (N = 10)					Length of 'sweat' glands (mm.) (N = 30)					Circumference of 'sweat' glands (mm.) (n = 50)				
	Mean	Stand. Dev.	Stand. err.	Coef. of Var(%)	Range	Mean	Stand. Dev.	Stand. err.	Coef. of Var(%)	Range	Mean	Stand. Dev.	Stand. err.	Coef. of Var(%)	Range
Forehead	1655	58	18	4	1573-1751	0.486	0.054	0.009	11	0.388-0.612	0.274	0.048	0.009	18	0.180-0.390
Cheek	2878	139	43	5	2639-3104	0.607	0.080	0.014	13	0.481-0.925	0.275	0.049	0.009	18	0.180-0.385
Neck (Dorsal)	2556	131	41	5	2301-2800	0.605	0.055	0.010	9	0.525-0.800	0.262	0.043	0.008	16	0.190-0.358
Neck (lateral)	2502	260	82	10	2182-2783	0.573	0.066	0.012	11	0.450-0.725	0.258	0.059	0.011	23	0.142-0.360
Neck (ventral)	2519	233	73	9	2284-3087	0.588	0.102	0.018	17	0.375-0.762	0.341	0.080	0.015	23	0.228-0.492
Back (thoracic)	2766	96	30	4	2571-2927	0.665	0.097	0.017	14	0.537-0.887	0.246	0.043	0.008	17	0.168-0.340
Back (lumbar)	2823	144	45	5	2554-3003	0.706	0.103	0.018	14	0.495-0.945	0.267	0.064	0.012	24	0.140-0.378
Back (sacral)	1740	211	66	12	1463-2148	0.816	0.133	0.024	16	0.580-1.200	0.248	0.064	0.012	26	0.103-0.392
Front Flank	2992	142	44	5	2732-3231	0.628	0.102	0;018	16	0.487-0.862	0.337	0.045	0.008	13	0.265-0.445
Hind Flank	2587	270	85	10	1911-2944	0.607	0.089	0.016	14	0.500-0.812	0.303	0.068	0.012	22	0.208-0.542
Shoulder	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gluteus	1636	105	33	6	1480-1801	0.592	0.061	0.011	10	0.512-0.700	0.352	0.063	0.012	18	0.253-0.480
Breast	2697	198	62	7	2470-3028	0.579	0.070	0.012	12	0.362-0.687	0.330	0.085	0.016	26	0.202-0.525
Abdomen	2798	181	57	7	2538-3037	0.634	0.064	0.011	10	0.530-0.780	0.273	0.049	0.009	18	0.182-0.348
Udder	1911	207	65	11	1522-2208	0.589	0.103	0.018	17	0.435-1.020	0.257	0.046	0.008	18	0.180-0.343
Axilla	3331	237	75	7	2935-3688	0.604	0.071	0.012	11	0.450-0.750	0.258	0.071	0.013	28	0.150-0.363
Groin	2742	94	30	3	2580-2876	0.614	0.053	0.009	8	0.500-0.750	0.274	0.056	0.010	20	0.155-0.380
Upper Foreleg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lower Foreleg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Upper Hindleg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lower Hindleg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE XXXVII (B)

SUMMARY OF THE MEASUREMENTS ON COW III

Body Regions	Circumference of capillary loops at the sub-epidermal level of skin (mm.) (N = 30)					Diameter of capillaries at the sub-epidermal level of skin (mm.) (N = 30)				
	Mean	Stand. Dev.	Stand. err.	Coef. of Var.(%)	Range	Mean	Stand. Dev.	Stand. err.	Coef. of Var.(%)	Range
Forehead	0.848	0.036	0.011	4	.800 - .900	0.039	0.011	0.0020	28	0.03 - 0.07
Cheek	0.628	0.062	0.020	10	.550 - .775	0.044	0.009	0.0016	20	0.02 - 0.06
Neck (dorsal)	0.610	0.085	0.029	2	.600 - .875	0.043	0.013	0.0023	30	0.02 - 0.08
Neck (lateral)	0.655	0.056	0.018	9	.575 - .750	0.045	0.011	0.0020	24	0.02 - 0.07
Neck (ventral)	0.638	0;096	0.030	15	.425 - .725	0.050	0.010	0.0018	20	0.03 - 0.07
Back (thoracic)	0.673	0.057	0.018	8	.575 - .750	0.048	0.011	0.0020	22	0.03 - 0.07
Back (lumbar)	0.730	0.078	0.025	11	.650 - .850	0.039	0.007	0.0013	18	0.03 - 0.05
Back (sacral)	0.903	0.075	0.024	8	.775 -1.025	0.050	0.009	0.0016	18	0.04 - 0.07
Front Flank	0.650	0.061	0.019	9	.575 - .775	0.047	0.010	0.0018	21	0.03 - 0.07
Hind Flank	0.750	0.055	0.017	7	.650 - .825	0.049	0.012	0.0021	24	0.03 - 0.08
Shoulder	-	-	-	-	-	-	-	-	-	-
Gluteus	0.830	0.082	0.026	10	.725 - .900	0.051	0.012	0.0021	23	0.03 - 0.08
Breast	0.670	0.051	0.016	8	.600 - .750	0.050	0.010	0.0018	20	0.03 - 0.08
Abdomen	0.718	0.053	0.017	7	.675 - .850	0.039	0.015	0.0027	38	0.02 - 0.09
Udder	0.875	0.176	0.055	20	.600 -1.125	0.048	0.008	0.0015	17	0.03 - 0.07
Axilla	0.608	0.072	0.023	12	.450 - .700	0.040	0.012	0.0021	30	0.02 - 0.06
Groin	0.708	0.066	0.021	9	.600 - .825	0.042	0.007	0.0013	17	0.03 - 0.06
Upper Foreleg	-	-	-	-	-	-	-	-	-	-
Lower Foreleg	-	-	-	-	-	-	-	-	-	-
Upper Hindleg	-	-	-	-	-	-	-	-	-	-
Lower Hindleg	-	-	-	-	-	-	-	-	-	-

TABLE XXXVII (C)

SUMMARY OF THE MEASUREMENTS ON COW III

Body Regions	Thickness of Skin (mm.) (N = 10)					Depth of 'sweat' glands (mm.) (N = 10)				
	Mean	Stand. Dev.	Stand. err.	Coef. of Var.(%)	Range	Mean	Stand. Dev.	Stand. err.	Coef. of Var.(%)	Range
Forehead	4.79	0.184	0.058	4	4.4 - 5.0	1.34	0.094	0.030	7	1.2 - 1.5
Cheek	4.59	0.081	0.025	2	4.0 - 4.8	1.53	0.126	0.039	8	1.4 - 1.8
Neck (dorsal)	5.42	0.148	0.046	3	5.2 - 5.6	1.64	0.067	0.021	4	1.5 - 1.7
Neck (lateral)	5.07	0.105	0.033	2	4.9 - 5.2	1.62	0.081	0.026	5	1.5 - 1.7
Neck (ventral)	6.41	0.170	0.053	3	6.1 - 6.7	2.13	0.012	0.004	6	2.0 - 2.4
Back (thoracic)	5.21	0.070	0.022	1	5.1 - 5.3	1.48	0.104	0.032	7	1.4 - 1.7
Back (lumbar)	5.17	0.105	0.033	2	5.0 - 5.3	1.55	0.066	0.021	4	1.5 - 1.7
Back (sacral)	5.89	0.134	0.042	2	5.7 - 6.1	1.74	0.094	0.030	5	1.6 - 1.9
Front Flank	6.13	0.060	0.018	1	6.0 - 6.2	1.49	0.075	0.024	5	1.4 - 1.6
Hind Flank	6.20	0.160	0.050	3	5.9 - 6.5	1.26	0.142	0.044	11	1.0 - 1.4
Shoulder	-	-	-	-	-	-	-	-	-	-
Gluteus	4.84	0.110	0.034	2	4.6 - 5.0	1.57	0.094	0.030	6	1.4 - 1.7
Breast	5.22	0.140	0.044	3	4.9 - 5.4	1.22	0.110	0.034	9	1.0 - 1.4
Abdomen	3.41	0.070	0.022	2	3.3 - 3.6	1.31	0.075	0.024	6	1.2 - 1.4
Udder	2.73	0.024	0.007	1	2.6 - 2.8	1.19	0.100	0.031	8	1.1 - 1.3
Axilla	-	-	-	-	-	-	-	-	-	-
Groin	3.78	0.130	0.041	3	3.6 - 4.0	1.26	0.066	0.021	5	1.2 - 1.4
Upper Foreleg	-	-	-	-	-	-	-	-	-	-
Lower Foreleg	-	-	-	-	-	-	-	-	-	-
Upper Hindleg	-	-	-	-	-	-	-	-	-	-
Lower Hindleg	-	-	-	-	-	-	-	-	-	-

TABLE XXXVIII (A)

SUMMARY OF THE MEASUREMENTS ON COW IV

Body Regions	No. of 'sweat' glands per sq. cm. of skin surface (N = 10)					Length of 'sweat' glands (mm.) (N = 30)					Circumference of 'sweat' glands (mm.) (N = 30)				
	Mean	Stand. Dev.	Stand. err.	Coef. of Var. (%)	Range	Mean	Stand. Dev.	Stand. err.	Coef. of Var. (%)	Range	Mean	Stand. Dev.	Stand. err	Coef. of Var (%)	Range
Forehead	1638	66	21	4	1556-1742	0.680	0.109	0.019	16	0.420-0.880	0.241	0.040	0.0072	17	0.160-0.510
Cheek	2310	122	38	5	2157-2495	0.599	0.027	0.004	4	0.500-0.810	0.299	0.067	0.0122	23	0.170-0;410
Neck (dorsal)	2243	143	45	6	2079-2554	0.578	0.083	0.015	14	0.450-0.760	0.276	0.062	0.0113	22	0.175-0.456
Neck (lateral)	2999	255	80	9	2656-3445	0.578	0.068	0.012	11	0.450-0.750	0.272	0.076	0.0138	28	0.140-0.475
Neck (ventral)	2478	160	50	7	2241-2732	0.599	0.089	0.016	14	0.450-0.830	0.277	0.064	0.0116	23	0.140-0.445
Back (thoracic)	1663	170	53	10	1446-1920	0.634	0.066	0.012	10	0.500-0.780	0.314	0.060	0.0109	19	0.190-0.430
Back (lumbar)	1142	46	15	4	1099-1235	0.624	0.074	0.013	11	0.505-0.760	0.325	0.098	0.0178	30	0.100-0.535
Back (sacral)	940	73	23	8	803-1057	0.706	0.094	0.017	13	0.500-0.875	0.373	0.089	0.0162	24	0.200-0.580
Front Flank	1663	168	53	10	1548-2021	0.631	0.076	0.013	12	0.500-0.837	0.298	0.076	0.0138	26	0.140-0.430
Hind Flank	1722	173	54	10	1573-2157	0.630	0.093	0.016	14	0.495-0.825	0.298	0.085	0.0155	29	0.130-0.490
Shoulder	2419	127	40	5	2324-2571	0.634	0.080	0.014	12	0.500-0.825	0.299	0.064	0.0116	21	0.179-0.435
Gluteus	941	64	20	7	846-1065	0.633	0.081	0.014	12	0.535-0.850	0.385	0.038	0.0069	9	0.180-0.770
Breast	1438	213	67	15	1116-1759	0.725	0.101	0.018	13	0.550-0.912	0.403	0.088	0.0160	22	0.270-0.597
Abdomen	1487	47	15	3	1483-1582	0.632	0.061	0.011	9	0.535-0.725	0.514	0.079	0.0144	15	0.350-0.670
Udder	1109	287	90	26	846-1895	0.635	0.075	0.031	11	0.500-0.770	0.436	0.055	0.0100	13	0.210-0.915
Axilla	2218	500	158	23	2089-2428	0.669	0.095	0.017	14	0.545-0.935	0.326	0.067	0.0122	21	0.200-0.580
Groin	1814	92	29	5	1700-1996	0.638	0.081	0.014	12	0.475-0.800	0.279	0.054	0.0098	19	0.170-0.365
Upper Foreleg	1982	267	84	15	1838-2098	0.603	0.078	0.014	12	0.450-0.775	0.307	0.099	0.0180	32	0.140-0.510
Lower Foreleg	991	60	19	6	871-1099	0.784	0.136	0.024	17	0.575-1.025	0.377	0.035	0.0063	9	0.250-0.780
Upper Hindleg	2176	117	37	5	2038-2360	0.645	0.121	0.022	18	0.945-0.420	0.317	0.038	0.0069	12	0.190-0.430
Lower Hindleg	754	30	10	4	719-803	0.766	0.130	0.023	16	0.560-0.975	0.406	0.037	0.0067	9	0.255-0.690

TABLE XXXVIII (B)

SUMMARY OF THE MEASUREMENTS ON COW IV

Body Regions	Circumference of capillary loops in the sub-epidermal level of skin (mm.) (N = 30)					Diameter of capillaries at the sub-epidermal level of skin (mm.) (N = 30)				
	Mean	Stand. Dev.	Stand. err.	Coef. of Var.(%)	Range	Mean	Stand. Dev.	Stand. err.	Coef. of Var.(%)	Range
Forehead	0.940	0.197	0.062	20	.650 -1.350	0.039	0.012	0.0031	30	0.01 - 0.07
Cheek	0.700	0.024	0.008	3	.550 - .800	0.036	0.015	0.0027	41	0.01 - 0.08
Neck (dorsal)	0.732	0.047	0.015	6	.650 - .800	0.031	0.011	0.0020	35	0.02 - 0.07
Neck (lateral)	0.758	0.089	0.028	12	.675 - .900	0.035	0.009	0.0016	26	0.02 - 0.05
Neck (ventral)	0.705	0.050	0.016	7	.625 - .800	0.041	0.009	0.0016	22	0.03 - 0.06
Back (thoracic)	0.825	0.099	0.031	12	.675 - .975	0.057	0.020	0.0036	29	0.03 - 0.12
Back (lumbar)	0.885	0.101	0.031	11	.700 -1.025	0.051	0.029	0.0052	47	0.03 - 0.14
Back (sacral)	1.043	0.225	0.071	22	.800 -1.350	0.063	0.018	0.0032	28	0.03 - 0.09
Front Flank	0.800	0.077	0.024	10	.600 -1.000	0.041	0.013	0.0025	31	0.02 - 0.07
Hind Flank	0.863	0.118	0.037	13	.800 -1.050	0.056	0.018	0.0032	32	0.03 - 0.11
Shoulder	0.618	0.087	0.028	14	.500 - .800	0.038	0.012	0.0021	31	0.02 - 0.07
Gluteus	1.000	0.073	0.023	7	.925 -1.150	0.058	0.023	0.0041	39	0.02 - 0.12
Breast	0.808	0.106	0.033	13	.600 - .950	0.070	0.024	0.0043	34	0.03 - 0.12
Abdomen	0.733	0.135	0.042	18	.625 - .775	0.067	0.024	0.0043	35	0.03 - 0.12
Udder	1.000	0.154	0.048	15	.700 -1.275	0.070	0.023	0.0041	32	0.04 - 0.12
Axilla	0.778	0.063	0.020	8	.700 - .900	0.046	0.016	0.0029	34	0.02 - 0.08
Groin	0.778	0.105	0.033	13	.650 -1.000	0.052	0.003	0.0005	6	0.02 - 0.13
Upper Foreleg	0.788	0.086	0.027	11	.700 - .925	0.062	0.021	0.0038	33	0.03 - 0.10
Lower Foreleg	1.120	0.104	0.032	9	.950 -1.300	0.056	0.014	0.0025	25	0.03 - 0.08
Upper Hindleg	0.931	0.123	0.038	13	.750 -1.100	0.059	0.022	0.0040	37	0.03 - 0.10
Lower Hindleg	1.108	0.150	0.047	14	.900 -1.300	0.068	0.031	0.0056	45	0.04 - 0.19

TABLE XXXVIII (C)

SUMMARY OF THE MEASUREMENTS ON COW IV

Body Regions	Thickness of skin (mm.) (N = 10)					Depth of 'sweat' glands (mm.) (N = 10)				
	Mean	Stand. Dev.	Stand. err.	Coef. of Var. (%)	Range	Mean	Stand. Dev.	Stand. err.	Coef. of Var. (%)	Range
Foreleg	3.60	0.249	0.078	7	3.1 - 3.9	1.83	0.144	0.045	8	1.8 - 2.8
Cheek	4.61	0.207	0.065	4	4.4 - 4.9	1.14	0.148	0.046	13	0.9 - 1.3
Neck (dorsal)	4.45	0.295	0.093	7	4.1 - 5.2	1.06	0.134	0.042	13	0.8 - 1.2
Neck (lateral)	4.93	0.148	0.046	3	4.7 - 5.2	1.05	0.164	0.051	16	0.9 - 1.4
Neck (ventral)	6.41	0.443	0.140	7	5.2 - 6.8	1.65	0.104	0.032	6	1.5 - 1.8
Back (thoracic)	4.24	0.283	0.089	7	3.6 - 4.5	1.46	0.134	0.042	9	1.3 - 1.6
Back (lumbar)	4.37	0.249	0.078	6	3.8 - 4.7	1.04	0.134	0.042	13	0.9 - 1.3
Back (sacral)	4.71	0.203	0.064	4	4.4 - 5.0	1.53	0.176	0.055	12	1.3 - 1.8
Front Flank	5.20	0.215	0.068	4	4.8 - 5.5	1.14	0.114	0.036	10	0.9 - 1.3
Hind Flank	4.43	0.226	0;071	5	4.2 - 5.0	0.95	0.083	0.026	9	0.8 - 1.1
Shoulder	3.62	0.209	0.066	6	3.4 - 3.8	0.88	0.076	0.024	9	0.7 - 1.0
Gluteus	4.35	0.403	0.127	9	3.4 - 4.8	0.93	0.067	0.021	7	0.8 - 1.0
Breast	4.31	0.184	0.058	4	4.0 - 4.5	1.32	0.100	0.031	8	1.1 - 1.4
Abdomen	3.29	0.164	0.051	5	3.1 - 3.5	1.07	0.104	0.032	10	0.9 - 1.3
Udder	3.76	0.217	0.068	6	3.4 - 4.1	0.96	0.063	0.020	7	0.9 - 1.1
Axilla	4.43	0.283	0.089	6	4.1 - 5.0	1.06	0.030	0.009	3	0.9 - 1.2
Groin	5.19	0.221	0.069	4	4.8 - 5.5	1.36	0;060	0.019	4	1.3 - 1.5
Upper Foreleg	4.65	0.158	0.050	3	4.4 - 4.9	1.75	0.070	0.022	4	1.7 - 1.9
Lower Foreleg	4.60	0.089	0.028	2	4.5 - 4.8	1.88	0.089	0.028	5	1.8 - 2.1
Upper Hindleg	4.73	0.078	0.024	2	4.6 - 4.9	1.65	0.170	0.053	10	1.4 - 1.9
Lower Hindleg	5.64	0.063	0.019	1	5.5 - 5.7	1.73	0.077	0.024	5	1.6 - 1.9

TABLE XXXIX (A)

SUMMARY OF THE MEASUREMENTS ON COW V

Body Regions	No. of 'sweat' glands per sq.cm. of skin surface (N = 10)					Length of 'sweat' glands (mm.) (N = 30)					Circumference of 'sweat' glands (mm.) (N = 30)				
	Mean	Stand.	Stand.	Coef. of Var. (%)	Range	Mean	Stand.	Stand.	Coef. of Var. (%)	Range	Mean	Stand.	Stand.	Coef. of Var. (%)	Range
Forehead	1730	123	38	7	1590-1903	0.528	0.058	0.0105	11	0.450-0.700	0.339	0.098	0.0178	29	0.170-0.560
Cheek	1663	148	46	9	1522-1869	0.547	0.057	0.0104	10	0.400-0.643	0.354	0.078	0.0142	22	0.235-0.480
Neck (dorsal)	-	-	-	-	-	0.517	0.050	0.0091	9	0.435-0.625	0.331	0.071	0.0129	21	0.260-0.590
Neck (lateral)	2360	98	31	4	2182-2504	0.565	0.094	0.0171	17	0.420-0.900	0.389	0.073	0.0133	22	0.250-0.500
Neck (ventral)	2117	99	31	5	2013-2318	0.562	0.070	0.0127	12	0.495-0.775	0.314	0.072	0.0131	23	0.195-0.470
Back (thoracic)	1814	93	29	5	1717-2013	0.601	0.106	0.0190	17	0.410-0.895	0.336	0.073	0.0131	21	0.225-0.580
Back (lumbar)	1067	102	32	10	930-1226	0.680	0.153	0.0240	19	0.450-1.125	0.424	0.086	0.0156	20	0.320-0.615
Back (sacral)	689	90	28	13	575-905	0.627	0.094	0.0171	15	0.500-0.950	0.428	0.087	0.0158	20	0.295-0.590
Front Flank	1873	64	20	3	1785-2021	0.658	0.111	0.0200	17	0.535-0.910	0.389	0.064	0.0116	17	0.250-0.475
Hind Flank	1126	49	16	4	1074-1209	0.538	0.051	0.0093	9	0.450-0.650	0.382	0.077	0.0140	20	0.230-0.570
Shoulder	2142	89	28	4	1979-2292	0.571	0.061	0.0111	11	0.490-0.750	0.303	0.187	0.0340	61	0.190-0.440
Gluteus	1126	67	21	5	1065-1285	0.586	0.051	0.0093	9	0.490-0.700	0.419	0.095	0.0173	23	0.300-0.625
Breast	1756	83	26	4	1632-1844	0.561	0.061	0.0111	11	0.460-0.660	0.399	0.097	0.0177	24	0.280-0.665
Abdomen	1529	67	21	4	1438-1658	0.552	0.024	0.0043	4	0.455-0.860	0.294	0.059	0.0107	20	0.200-0.500
Udder	808	122	38	15	693-1125	0.556	0.094	0.0171	17	0.425-0.775	0.314	0.053	0.0096	17	0.210-0.410
Axilla	2142	80	25	3	2013-2309	0.636	0.099	0.0180	16	0.506-0.950	0.241	0.049	0.0089	20	0.155-0.360
Groin	1848	137	43	7	1641-2089	0.587	0.083	0.0149	14	0.460-0.775	0.277	0.039	0.0071	14	0.220-0.355
Upper Foreleg	1016	84	27	8	922-1192	0.606	0.093	0.0167	15	0.450-0.800	0.288	0.046	0.0083	16	0.200-0.380
Lower Foreleg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Upper Hindleg	2386	53	17	2	2292-2461	0.651	0.113	0.0200	7	0.500-1.100	0.256	0.060	0.0109	23	0.145-0.365
Lower Hindleg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE XXXIX (B)

SUMMARY OF THE MEASUREMENTS ON COW V

Body Regions	Circumference of capillary loops at the sub-epidermal level of skin (mm.) (N = 30)					Diameter of capillaries at the sub-epidermal level of skin (mm.) (N = 30)				
	Mean	Stand. Dev.	Stand. err.	Coef. of Var.(%)	Range	Mean	Stand. Dev.	Stand. err.	Coef. of Var.(%)	Range
Forehead	0.848	0.119	0.037	14	.650-1.050	0.038	0.010	0.0018	26	0.02-0.06
Cheek	0.803	0.065	0.021	8	.725-..935	0.045	0.014	0.0025	31	0.03-0.09
Neck (dorsal)	0.743	0.109	0.034	14	.600- .950	0.044	0.010	0.0018	22	0.02-0.06
Neck (lateral)	0.748	0.066	0.021	9	.675- .875	0.044	0.010	0.0018	22	0.03-0.08
Neck (ventral)	0.853	0.064	0.020	8	.725- .925	0.043	0.014	0.0025	32	0.02-0.08
Back (thoracic)	0.765	0.088	0.028	12	.625- .900	0.044	0.012	0.0021	27	0.02-0.07
Back (lumbar)	1.060	0.356	0.112	34	.875-1.200	0.045	0.010	0.0018	22	0.03-0.06
Back (sacral)	1.003	0.067	0.021	7	.900-1.100	0.043	0.016	0.0029	37	0.02-0.09
Front Flank	0.768	0.087	0.028	11	.625- .875	0.047	0.008	0.0015	17	0.03-0.07
Hind Flank	0.985	0.079	0.025	8	.850-1.100	0.050	0.010	0.0018	20	0.03-0.07
Shoulder	0.723	0.104	0.032	14	.550- .850	0.043	0.011	0.0020	25	0.02-0.06
Gluteus	1.008	0.146	0.046	14	.750-1.250	0.044	0.010	0.0018	22	0.03-0.07
Breast	0.825	0.150	0.047	18	.650-1.050	0.043	0.013	0.0023	30	0.02-0.08
Abdomen	0.890	0.105	0.033	11	.775-1.075	0.037	0.009	0.0016	24	0.02-0.05
Udder	1.103	0.188	0.059	17	.725-1.400	0.050	0.011	0.0020	22	0.03-0.08
Axilla	0.718	0.141	0.044	19	.575- .925	0.037	0.009	0.0016	24	0.02-0.06
Groin	0.803	0.112	0.035	13	.625- .975	0.041	0.011	0.0020	26	0.02-0.06
Upper Foreleg	1.040	0.113	0.035	11	.850-1.225	0.039	0.009	0.0016	23	0.02-0.06
Lower Foreleg	-	-	-	-	-	-	-	-	-	-
Upper Hindleg	0.620	0.056	0.018	9	.500- .725	0.037	0.009	0.0016	24	0.02-0.06
Lower Hindleg	-	-	-	-	-	-	-	-	-	-

TABLE XXXIX (C)

SUMMARY OF THE MEASUREMENTS ON COW V

Body Regions	Thickness of skin (mm.) (N = 10)					Depth of 'sweat' glands (mm.) (N = 10)				
	Mean	Stand. Dev.	Stand. Err.	Coef. of Var.(%)	Range	Mean	Stand. Dev.	Stand. Err.	Coef. of Var.(%)	Range
Forehead	5.31	0.337	0.106	6	5.0 - 5.5	1.51	0.033	0.010	2	1.5 - 1.6
Cheek	4.10	0.077	0.024	2	4.0 - 4.3	1.57	0.066	0.021	4	1.5 - 1.7
Neck (dorsal)	6.31	0.110	0.034	2	6.1 - 6.5	2.00	0.126	0.039	6	1.8 - 2.2
Neck (lateral)	5.76	0.114	0.036	2	5.6 - 5.9	1.43	0.081	0.026	6	1.3 - 1.5
Neck (ventral)	6.23	0.077	0.024	1	6.1 - 6.4	1.96	0.021	0.007	1	1.9 - 2.0
Back (thoracic)	5.33	0.063	0.019	1	5.2 - 5.4	1.43	0.125	0.039	9	1.3 - 1.7
Back (lumbar)	6.00	0.114	0.036	2	5.9 - 6.3	1.50	0.000	0.000	0	1.5 - 1.5
Back (sacral)	5.07	0.130	0.041	3	4.9 - 5.2	1.26	0.104	0.032	8	1.1 - 1.4
Front Flank	6.86	0.181	0.057	3	6.4 - 7.0	1.41	0.074	0.025	5	1.3 - 1.5
Hind Flank	5.99	0.634	0.200	10	4.3 - 6.4	1.20	0.167	0.052	14	0.9 - 1.5
Shoulder	5.02	0.187	0.059	4	4.7 - 5.3	1.56	0.115	0.036	7	1.4 - 1.8
Gluteus	5.99	0.118	0.037	2	5.8 - 6.2	1.21	0.120	0.037	10	1.1 - 1.4
Breast	5.01	0.317	0.100	6	4.5 - 5.6	1.51	0.137	0.043	9	1.3 - 1.7
Abdomen	3.61	0.189	0.059	5	3.4 - 3.9	1.17	0.081	0.026	7	1.0 - 1.3
Udder	4.79	0.512	0.162	10	4.2 - 6.0	1.66	0.176	0.055	11	1.3 - 2.0
Axilla	3.94	0.189	0.059	5	3.7 - 4.4	1.36	0.163	0.051	12	1.2 - 1.7
Groin	5.55	0.327	0.103	6	5.2 - 6.1	1.40	0.182	0.057	13	1.2 - 1.8
Upper Foreleg	5.67	0.149	0.047	3	5.3 - 5.8	1.79	0.057	0.018	3	1.7 - 1.9
Lower Foreleg	-	-	-	-	-	-	-	-	-	-
Upper Hindleg	4.79	0.154	0.048	3	4.5 - 5.0	1.66	0.170	0.053	10	1.4 - 1.9
Lower Hindleg	-	-	-	-	-	-	-	-	-	-

TABLE XL (A)

SUMMARY OF THE MEASUREMENTS ON COW VI

Body Regions	No. of 'sweat glands per sq.cm. of skin surface (N = 10)					Length of 'sweat' glands (mm.) (N = 30)					Circumference of 'sweat' glands (mm.) (N = 30)				
	Mean	Stand Dev.	Stand Err	Coef. of Var(%)	Range	Mean	Stand Dev.	Stand Err.	Coef. of Var(%)	Range	Mean	Stand Dev.	Stand Err.	Coef. of Var(%)	Range
Forehead	1302	289	92	22	1201-1421	0.670	0.096	0.0175	14	0.500-0.905	0.325	0.066	0.0120	20	0.106-0.393
Cheek	1957	145	46	7	1708-2191	0.656	0.151	0.0270	23	0.525-0.906	0.340	0.076	0.0138	22	0.190-0.470
Neck (dorsal)	2083	131	41	6	1920-2309	0.618	0.081	0.0147	13	0.545-0.757	0.290	0.066	0.0120	23	0.158-0.475
Neck (lateral)	1999	179	56	9	1641-2284	0.546	0.060	0.0109	11	0.450-0.681	0.272	0.075	0.0136	28	0.160-0.435
Neck (ventral)	2117	124	39	5	1886-2360	0.655	0.090	0.0164	14	0.485-0.935	0.266	0.053	0.0096	20	0.165-0.364
Back (thoracic)	2276	119	37	5	2089-2453	0.602	0.083	0.0151	14	0.425-0.875	0.299	0.071	0.0129	24	0.140-0.500
Back (lumbar)	1428	62	19	4	1378-1531	0.826	0.132	0.0240	15	0.600-1.155	0.374	0.065	0.0118	17	0.250-0.600
Back (sacral)	706	118	37	16	516-888	0.759	0.116	0.0210	15	0.550-1.037	0.480	0.038	0.0060	7	0.370-0.850
Front Flank	1705	96	30	5	1531-1852	0.742	0.121	0.0220	16	0.600-1.018	0.261	0.053	0.0096	20	0.173-0.360
Hind Flank	1806	86	27	4	1658-1928	0.704	0.094	0.0171	13	0.575-0.950	0.321	0.073	0.0133	12	0.170-0.500
Shoulder	2318	78	27	3	2199-2444	0.665	0.069	0.0125	10	0.525-0.805	0.359	0.061	0.0111	18	0.230-0.470
Gluteus	1117	203	64	18	854-1446	0.672	0.093	0.0169	14	0.525-0.870	0.406	0.021	0.0038	5	0.273-0.560
Breast	2092	127	40	6	1861-2309	0.658	0.089	0.0162	14	0.525-0.825	0.403	0.075	0.0136	19	0.280-0.530
Abdomen	1630	78	24	4	1505-1801	0.620	0.079	0.0144	13	0.510-0.810	0.449	0.070	0.0127	16	0.315-0.595
Udder	1092	142	45	13	862-1285	0.660	0.085	0.0155	13	0.520-0.850	0.399	0.090	0.0160	23	0.230-0.570
Axilla	1554	160	50	10	1319-1785	0.653	0.075	0.0136	11	0.500-0.775	0.415	0.089	0.0162	21	0.315-0.680
Groin	1663	119	37	7	1522-1903	0.624	0.082	0.0149	13	0.475-0.830	0.587	0.172	0.0310	29	0.310-1.015
Upper Foreleg	1621	114	36	7	1505-1835	0.689	0.080	0.0145	12	0.550-0.835	0.455	0.074	0.0135	16	0.320-0.620
Lower Foreleg	865	92	29	10	710-1032	0.830	0.134	0.0240	16	0.580-1.050	0.451	0.100	0.0180	22	0.300-0.750
Upper Hindleg	1982	81	25	4	1861-2148	0.710	0.141	0.0250	19	0.510-1.025	0.417	0.075	0.0140	18	0.240-0.570
Lower Hindleg	1075	87	27	8	955-1285	0.769	0.126	0.0220	16	0.625-1.035	0.447	0.078	0.0142	17	0.300-0.620

TABLE XL (B)

SUMMARY OF THE MEASUREMENTS ON COW VI

Body Regions	Circumference of capillary loops at the sub-epidermal level of skin (mm.) (N = 30)					Diameter of capillaries at the sub-epidermal level of skin (mm.) (N = 30)				
	Mean	Stand. Dev.	Stand. Err.	Coef. of Var.(%)	Range	Mean	Stand. Dev.	Stand. Err.	Coef. of Var.(%)	Range
Forehead	0.948	0.160	0.048	11	.700 -1.075	0.053	0.019	0.0034	35	0.02 - 0.08
Cheek	0.860	0.117	0.037	13	.675 -1.100	0.045	0.014	0.0025	31	0.02 - 0.08
Neck (dorsal)	0.778	0.070	0.022	9	.675 - .875	0.047	0.014	0.0025	29	0.02 - 0.07
Neck (lateral)	0.838	0.133	0.042	15	.675 -1.025	0.044	0.018	0.0032	40	0.02 - 0.10
Neck (ventral)	0.815	0.089	0.028	11	.675 -1.000	0.054	0.026	0.0040	48	0.03 - 0.12
Back (thoracic)	0.775	0.107	0.033	13	.625 - .950	0.047	0.015	0.0027	31	0.02 - 0.09
Back (lumbar)	0.890	0.147	0.046	16	.725 -1.175	0.050	0.015	0.0027	30	0.02 - 0.09
Back (sacral)	1.095	0.152	0.048	14	.900 -1.350	0.053	0.015	0.0027	28	0.03 - 0.09
Front Flank	0.798	0.130	0.041	16	.600 -1.050	0.054	0.019	0.0034	35	0.03 - 0.10
Hind Flank	0.850	0.152	0.048	17	.600 -1.150	0.048	0.013	0.0023	27	0.03 - 0.08
Shoulder	0.730	0.073	0.020	7	.675 - .850	0.051	0.014	0.0025	27	0.03 - 0.08
Gluteus	1.068	0.130	0.041	12	.925 -1.325	0.059	0.022	0.0040	37	0.03 - 0.11
Breast	0.743	0.087	0.028	12	.600 - .850	0.053	0.015	0.0027	28	0.03 - 0.08
Abdomen	0.830	0.105	0.033	12	.675 -1.025	0.051	0.020	0.0036	39	0.02 - 0.09
Udder	0.988	0.092	0.029	9	.900 -1.150	0.053	0.016	0.0029	30	0.03 - 0.11
Axilla	0.730	0.059	0.019	8	.650 - .850	0.056	0.015	0.0027	26	0.03 - 0.09
Groin	0.823	0.087	0.028	11	.700 - .960	0.039	0.012	0.0021	30	0.02 - 0.07
Upper Foreleg	0.768	0.076	0.024	10	.650 - .950	0.045	0.012	0.0021	26	0.03 - 0.08
Lower Foreleg	1.128	0.100	0.031	9	.950 -1.275	0.049	0.014	0.0025	28	0.02 - 0.08
Upper Hindleg	0.773	0.091	0.029	12	.625 - .950	0.047	0.012	0.0021	25	0.03 - 0.08
Lower Hindleg	1.110	0.170	0.053	15	.900 -1.500	0.051	0.019	0.0034	37	0.02 - 0.09

TABLE XL (C)

SUMMARY OF THE MEASUREMENTS ON COW VI

Body Regions	Thickness of skin (mm.) (N = 10)					Depth of 'sweat' glands (mm.) (N = 10)				
	Mean	Stand. Dev.	Stand. Err.	Coef. of Var. (%)	Range	Mean	Stand. Dev.	Stand. Err.	Coef. of Var. (%)	Range
Forehead	5.19	0.095	0.030	2	5.0 - 5.3	1.83	0.148	0.046	8	1.7 - 2.2
Cheek	3.23	0.298	0.094	9	2.9 - 3.7	1.43	0.070	0.022	5	1.3 - 1.6
Neck (dorsal)	6.29	0.145	0.045	2	6.1 - 6.5	1.78	0.089	0.028	5	1.6 - 1.9
Neck (lateral)	5.00	0.105	0.033	2	4.9 - 5.2	1.42	0.077	0.024	5	1.3 - 1.5
Neck (ventral)	5.82	0.109	0.034	2	5.7 - 6.0	1.64	0.094	0.030	6	1.5 - 1.8
Back (thoracic)	5.67	0.239	0.075	4	5.3 - 6.0	1.44	0.134	0.042	9	1.2 - 1.7
Back (lumbar)	6.15	0.170	0.053	3	5.9 - 6.4	1.59	0.109	0.034	7	1.4 - 1.7
Back (sacral)	6.91	0.134	0.042	2	6.7 - 7.1	1.75	0.130	0.041	8	1.5 - 1.9
Front Flank	5.48	0.308	0.097	6	4.8 - 5.8	1.30	0.065	0.020	5	1.2 - 1.4
Hind Flank	6.74	0.095	0.030	1	6.6 - 6.9	1.51	0.094	0.030	6	1.4 - 1.7
Shoulder	4.90	0.176	0.055	4	4.6 - 5.2	1.53	0.141	0.044	9	1.3 - 1.8
Gluteus	4.62	0.175	0.055	4	4.4 - 4.9	1.38	0.063	0.020	5	1.3 - 1.5
Breast	6.21	0.495	0.156	8	5.6 - 6.8	1.44	0.148	0.046	10	1.2 - 1.6
Abdomen	3.66	0.084	0.026	2	3.5 - 3.8	1.36	0.104	0.032	8	1.2 - 1.5
Udder	5.08	0.228	0.072	4	4.8 - 5.5	1.49	0.158	0.050	11	1.2 - 1.8
Axilla	5.06	0.346	0.109	7	4.5 - 5.4	1.41	0.164	0.051	12	1.2 - 1.7
Groin	3.85	0.114	0.036	3	3.7 - 4.0	1.37	0.090	0.028	6	1.2 - 1.5
Upper Foreleg	3.69	0.145	0.045	4	3.5 - 3.9	1.40	0.089	0.028	6	1.2 - 1.5
Lower Foreleg	5.91	0.190	0.060	3	5.6 - 6.1	2.26	0.170	0.053	8	1.9 - 2.5
Upper Hindleg	4.83	0.130	0.041	3	4.6 - 5.0	1.95	0.170	0.053	9	1.7 - 2.2
Lower Hindleg	6.39	0.316	0.100	5	6.0 - 7.2	1.83	0.114	0.036	6	1.6 - 2.0

TABLE XLI (A)

SUMMARY OF THE MEASUREMENTS ON THE CALF

Body Regions	No. of 'sweat' glands per sq.cm. of skin surface (N = 10)					Length of 'sweat' glands (mm.) (N = 30)					Circumference of 'sweat glands (mm.) (N = 30)				
	Mean	Stand Dev.	Stand Err	Coef. of Var(%)	Range	Mean	Stand Dev.	Stand Err.	Coef. of Var(%)	Range	Mean	Stand Dev.	Stand Err.	Coef. of Var(%)	Range
Forehead	11170	380	120	3	10550-11950	0.420	0.080	0.0145	19	0.293-0.593	0.276	0.046	0.0085	17	0.190-0.350
Cheek	9780	460	163	4	9250-10600	0.346	0.047	0.0085	14	0.250-0.475	0.301	0.063	0.0114	21	0.200-0.480
Neck (dorsal)	13385	1040	329	8	11450-14700	0.382	0.069	0.0125	18	0.250-0.500	0.273	0.065	0.0118	24	0.180-0.410
Neck (lateral)	12405	1140	361	9	10750-13950	0.369	0.045	0.0082	12	0.287-0.481	0.327	0.074	0.0135	23	0.200-0.470
Neck (ventral)	13755	560	177	4	13100-14550	0.379	0.039	0.0071	10	0.300-0.462	0.307	0.019	0.0034	6	0.280-0.440
Back (thoracic)	13155	590	186	4	12200-14100	0.349	0.057	0.0104	16	0.225-0.475	0.287	0.064	0.0116	22	0.210-0.460
Back (lumbar)	13455	1040	329	7	11850-14900	0.374	0.065	0.0118	17	0.280-0.550	0.292	0.052	0.0094	18	0.200-0.395
Back (sacral)	10205	1300	412	12	8650-12000	0.521	0.011	0.0020	2	0.400-0.950	0.337	0.064	0.0116	19	0.240-0.470
Front Flank	15285	1310	415	8	12950-17250	0.442	0.061	0.0111	14	0.325-0.581	0.322	0.073	0.0131	22	0.220-0.515
Hind Flank	16335	2770	277	17	11200-20100	0.402	0.056	0.0102	14	0.300-0.525	0.294	0.056	0.0102	19	0.210-0.445
Shoulder	12320	750	237	6	10750-13550	0.491	0.055	0.0100	11	0.368-0.575	0.259	0.061	0.0111	24	0.145-0.385
Gluteus	11360	1020	323	9	10250-13000	0.483	0.066	0.0120	14	0.381-0.600	0.274	0.050	0.0091	18	0.200-0.390
Breast	11225	1050	332	9	9350-13550	0.526	0.098	0.0178	19	0.400-0.712	0.383	0.090	0.0164	23	0.240-0.595
Abdomen	12860	1780	560	13	9950-16400	0.504	0.087	0.0158	17	0.400-0.720	0.310	0.056	0.0102	18	0.225-0.400
Udder	-	-	-	-	-	0.532	0.106	0.0019	19	0.400-0.835	0.297	0.052	0.0094	18	0.220-0.460
Axilla	5400	380	120	17	5100-6000	0.466	0.057	0.0104	12	0.381-0.612	0.325	0.081	0.0147	25	0.175-0.475
Groin	11660	730	231	6	10400-12600	0.456	0.052	0.0094	11	0.375-0.600	0.343	0.070	0.0127	20	0.240-0.580
Upper Foreleg	8845	800	253	9	7700-10250	0.608	0.078	0.0142	13	0.475-0.787	0.354	0.083	0.0151	23	0.235-0.460
Lower Foreleg	4660	700	221	15	3950-6000	0.629	0.099	0.0180	16	0.462-0.875	0.297	0.070	0.0127	24	0.190-0.495
Upper Hindleg	4930	650	205	13	3900-6100	0.490	0.083	0.0151	17	0.375-0.735	0.358	0.086	0.0156	24	0.240-0.485
Lower Hindleg	6555	590	186	9	5450-7550	0.598	0.134	0.0240	22	0.412-0.918	0.343	0.058	0.0105	17	0.255-0.460

TABLE XLI (B)

SUMMARY OF THE MEASUREMENTS ON THE CALF

Body Regions	Circumference of capillary loops at the sub-epidermal level of skin (mm.) (N = 30)					Diameter of capillaries at the sub-epidermal level of skin (mm.) (N = 30)				
	Mean	Stand. Dev.	Stand. Err.	Coef. of Var. (%)	Range	Mean	Stand. Dev.	Stand. Err.	Coef. of Var. (%)	Range
Forehead	0.409	0.096	0.030	23	.250 - .530	0.029	0.007	0.0013	24	0.02 - 0.04
Cheek	0.355	0.052	0.016	15	.300 - .450	0.030	0.007	0.0013	23	0.02 - 0.04
Neck (dorsal)	0.359	0.071	0.022	20	.280 - .500	0.032	0.006	0.0011	19	0.02 - 0.04
Neck (lateral)	0.359	0.003	0.001	8	.325 - .410	0.028	0.004	0.0008	14	0.02 - 0.04
Neck (ventral)	0.347	0.041	0.013	12	.300 - .430	0.030	0.006	0.0011	20	0.02 - 0.04
Back (thoracic)	0.414	0.064	0.020	15	.350 - .550	0.030	0.008	0.0015	27	0.02 - 0.05
Back (lumbar)	0.404	0.058	0.018	14	.330 - .500	0.032	0.007	0.0013	22	0.02 - 0.05
Back (sacral)	0.398	0.076	0.024	19	.320 - .600	0.030	0.006	0.0011	20	0.02 - 0.04
Front Flank	0.414	0.063	0.020	15	.310 - .510	0.034	0.008	0.0015	24	0.02 - 0.05
Hind Flank	0.364	0.037	0.012	10	.300 - .410	0.037	0.009	0.0016	24	0.02 - 0.05
Shoulder	0.348	0.047	0.015	14	.260 - .410	0.029	0.006	0.0011	21	0.02 - 0.04
Gluteus	0.525	0.107	0.033	20	.400 - .750	0.030	0.006	0.0011	20	0.02 - 0.04
Breast	0.407	0.051	0.016	13	.350 - .525	0.029	0.007	0.0013	24	0.02 - 0.05
Abdomen	0.382	0.037	0.012	10	.325 - .450	0.032	0.009	0.0016	28	0.02 - 0.05
Udder	0.367	0.095	0.030	26	.285 - .620	0.032	0.009	0.0016	28	0.02 - 0.05
Axilla	0.446	0.052	0.016	12	.350 - .530	0.037	0.008	0.0015	22	0.02 - 0.05
Groin	0.386	0.037	0.012	10	.310 - .450	0.033	0.008	0.0015	24	0.02 - 0.04
Upper Foreleg	0.443	0.041	0.013	9	.375 - .525	0.033	0.009	0.0016	27	0.02 - 0.05
Lower Foreleg	0.518	0.071	0.022	14	.400 - .630	0.032	0.008	0.0015	25	0.02 - 0.05
Upper Hindleg	0.447	0.080	0.025	18	.330 - .580	0.033	0.007	0.0013	21	0.02 - 0.05
Lower Hindleg	0.503	0.070	0.022	14	.430 - .570	0.039	0.010	0.0018	25	0.02 - 0.05

TABLE XLI (C)

SUMMARY OF THE MEASUREMENTS ON THE CALF

Body Regions	Thickness of skin (mm.) (N = 10)					Depth of 'sweat' glands (mm.) (N = 10)				
	Mean	Stand. Dev.	Stand. Err.	Coef. of Var.	Range	Mean	Stand. Dev.	Stand. Err.	Coef. of Var.	Range
Forehead	2.52	0.220	0.069	9	2.1 - 2.7	1.15	0.28	0.088	24	0.9 - 1.6
Cheek	2.17	0.240	0.075	11	1.8 - 2.6	0.66	0.09	0.025	14	0.5 - 0.7
Neck (dorsal)	2.05	0.250	0.079	12	1.8 - 2.6	0.72	0.08	0.025	11	0.6 - 0.8
Neck (lateral)	3.00	0.120	0.037	4	2.7 - 3.1	0.68	0.13	0.004	19	0.5 - 0.8
Neck (ventral)	2.40	0.260	0.082	11	2.0 - 2.9	0.62	0.08	0.025	13	0.5 - 0.7
Back (thoracic)	1.50	0.130	0.041	9	1.3 - 1.7	0.63	0.01	0.003	2	0.4 - 0.8
Back (lumbar)	1.68	0.140	0.044	8	1.5 - 2.0	0.85	0.03	0.004	4	0.8 - 0.9
Back (sacral)	1.68	0.110	0.034	7	1.4 - 1.8	0.79	0.06	0.008	8	0.7 - 0.9
Front Flank	2.03	0.180	0.056	9	1.8 - 2.3	1.05	0.11	0.034	10	0.9 - 1.3
Hind Flank	2.56	0.120	0.037	5	2.3 - 2.7	0.94	0.07	0.022	7	0.8 - 1.0
Shoulder	1.37	0.110	0.034	8	1.2 - 1.5	0.67	0.09	0.028	13	0.5 - 0.8
Gluteus	1.63	0.130	0.041	8	1.4 - 1.8	0.62	0.06	0.019	10	0.5 - 0.7
Breast	1.87	0.160	0.050	9	1.6 - 2.1	1.01	0.11	0.034	11	0.9 - 1.2
Abdomen	1.85	0.090	0.030	5	1.7 - 2.0	0.97	0.17	0.053	17	0.8 - 1.3
Udder	1.90	0.170	0.053	9	1.5 - 2.1	0.77	0.08	0.025	10	0.6 - 0.9
Axilla	1.48	0.090	0.030	6	1.4 - 1.6	0.58	0.06	0.019	10	0.5 - 0.7
Groin	1.58	0.080	0.026	5	1.5 - 1.7	0.69	0.03	0.009	4	0.6 - 0.7
Upper Foreleg	1.65	0.080	0.026	5	1.5 - 1.8	0.80	0.000	0.000	-	0.8 - 0.8
Lower Foreleg	1.71	0.080	0.026	5	1.6 - 1.9	0.87	0.04	0.013	5	0.8 - 0.9
Upper Hindleg	1.77	0.140	0.044	8	1.5 - 2.0	0.75	0.07	0.022	8	0.6 - 0.8
Lower Hindleg	1.70	0.080	0.026	5	1.5 - 1.8	0.72	0.06	0.019	5	0.6 - 0.8

TABLE XLII

DISTRIBUTION OF THE DIFFERENT BODY REGIONS ACCORDING TO THE NUMBER OF 'SWEAT' GLANDS PER SQ. CM. OF SKIN

	AGE							
	3 to 4 years						9 years	8 days
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf II
Mean (M)*	2134	2508	1720	1622	1638	1871	1335	10593
Standard deviation (S.D.)	699	160	608	532	469	500	345	3633
M + 2 S.D.								
Regions of the body in which the number of 'sweat' glands per sq.cm. of skin lies between the mean + 2S.D. and the mean + S.D.	NV		NV		NV	NV	NV	
			NL	NL		NL	NL	
	AX	AX				AX		
			SH		SH		SH	
							FF	FF
					BT			
	UF							
				UH				
								HF
							ND	
M + S.D.								
Regions of the body in which the number of 'sweat' glands per sq.cm. of skin lies between the mean + S.D. and the mean.	ND	ND	ND	ND	ND	ND		ND
	GR	GR	GR	GR	GR	GR	GR	GR
	BR	BR		BR	BR	BR	BR	BR
		CH	CH	CH	CH	CH	CH	
	FF	FF		FF	FF	FF		
	HF	HF	HF		HF	HF		
	UH		UH		UH	UH		
	BT	BT		BT		BT		BT
		AB				AB		AB
			AX	AX				
		NV		NV				NV
				SH		SH		SH
			UF			UF	UF	
								GL
		BL						BL
				FH				FH
					NL			NL
		UD						
Mean								
Regions of the body in which the number of 'sweat' glands per sq.cm. of skin lies between the mean and the mean - S.D.	AB		AB	AB	AB		AB	
	BL		BL		BL	BL	BL	
	FH		FH		FH	FH		
	GL			GL			GL	
	NL	NL						
				UF	UF			UF
	SH							
							UH	
						UD		
							LF	
				HF			HF	
			FF					
	CH							CH
			BR					
			BT				BT	
								BS
					AX		AX	
Mean - S.D.								
Regions of the body in which the number of 'sweat' glands per sq.cm. of skin lies between the mean - S.D. and mean - 2 S.D.	BS	BS	BS	BS	BS	BS	BS	
	LF		LF		IF	LF		LF
	LH		LH		LH	LH	LH	LH
		UD	UD	UD	UD		UD	UD
		GL	GL		GL	GL		
		FH					FH	
								AX
				BL				
								UH
M - 2 S.D.								

* The mean used here is the mean of all the numbers of sweat glands per sq. cm. found for all the regions studied in each animal.

Table 42

TABLE XLIII

DISTRIBUTION OF THE DIFFERENT BODY REGIONS ACCORDING TO THE LENGTH OF THE 'SWEAT' GLANDS (mm.)

	AGE							
	3 - 4 YEARS						9 years	8 days
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf II
Mean (M.)	0.67	0.62	0.65	0.59	0.68	0.65	0.76	0.47
Standard Deviation (S.D.)	0.10	0.07	0.06	0.05	0.20	0.06	0.11	0.09
M + 2 S.D.	LH		LH			LH		LH
	BS	BS				BS		
	UH		UH				UH	
		BL		BL				
			LF			LF		LF
	GR							
			BR					
				FF				
							FH	
								UF
M + S.D.								
	AX		AX	AX		AX		
			BS	BS	BS		BS	BS
		FF			FF	FF		
					BL	BL	BL	
		BT		BT				
	AB	AB						AB
	FH		FH					
	LF				LF			
				UF	UF		UF	
					UH	UH		UH
							UD	UD
	UD							GL
	GL							
					HF			
					LH			
								SH
	NV							
M		GR	GR	GR	GR	GR	GR	GR
		GL	GL	GL	GL	GL		
	ND	ND	ND		ND	ND	ND	ND
	NL	NL	NL	NL	NL		NL	
		NV	NV	NV	NV	NV		
		UD	UD	UD	UD	UD		
			AB	AB	AB	AB	AB	
		BR		BR	BR	BR	BR	
		CH	CH	CH	CH			
			SH	SH	SH	SH		
			BT		BT	BT	BT	
		HF	HF			HF	HF	HF
						UF		
	UF		UF				FF	FF
	FF		FF					
	BL		BL				AX	AX
	AX				AX			
					FH	FH		FH
				UF				
M - S.D.						CH		CH
	CH							
		FH		FH				
	HF			HF				BT
	BL							
	BR							
				ND				
						NL		NL
							SH	
	SH							BL
							NV	NV
M - 2 S.D.								

Table 43

TABLE XLIV

DISTRIBUTION OF THE DIFFERENT BODY REGIONS ACCORDING TO THE CIRCUMFERENCE OF THE 'SWEAT' GLANDS (mm.)

	AGE							
	3 - 4 YEARS						9 years	8 days
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf II
Mean (M.)	.35	.29	.33	.34	.38	.34	.37	.31
Standard Deviation (SD)	.05	.04	.07	.06	.09	.04	.05	.03
M + 2 S.D.	BS			BS	BS	BS	BS	
		GL		GL		GL		
			AB			AB		
		BR	BR					BR
	BL			BL			BL	
			LH			LH		LH
		FF						
					GR			GR
						LF		
		NV						
			UD					
						UF		UF
								UH
M + S.D.								
	BR			BR	BR	BR	BR	
	GL			GL		GL	GL	
	HF	HF		HF			HF	
	AB				AB			AB
					AX			AX
			BS					BS
				FT				FT
			LF		LF		LF	
	LH				LH			
							NL	NL
					UD	UD		
	UF				UF			
						BL		
				CH				
						GR		
							ND	
	NV							
	SH							
					UH			
M								
	BT			BT	BT	BT	BT	BT
	ND	ND	ND	ND	ND			
	AX	AX	AX			AX	AX	
	NL	NL	NL	NL				
			SH	SH	SH	SH	SH	
		CH	CH		CH		CH	CH
	FT		FT			FT	FT	
		BL	BL		BL			BL
	FH	FH		FH				
	GR	GR	GR					
			HF		HF	HF		HF
			NV	NV		NV	NV	NV
	UD	UD		UD			UD	UD
		AB		AB			AB	
	LF							LF
			UF	UF			UF	
			UH			UH	UH	
							LH	
M - S.D.								
			FH		FH	FH	FH	
	CH					CH		
				GR			GR	
						ND		ND
					NL	NL		
	UH			UH				
				AX				
			BS					
			BT					
					NV			
								SH
								GL
					FF			

Table 44

TABLE XLV

DISTRIBUTION OF THE DIFFERENT BODY REGIONS ACCORDING TO THE AREA OF SECRETING SURFACE OF A SINGLE 'SWEAT' GLAND (Sq. mm.)

	AGE							
	3 - 4 YEARS						9 years 8 days	
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf II
Mean (m)	0.175	0.232	0.218	0.198	0.258	0.223	0.276	0.146
Standard Deviation (S.D.)	0.023	0.056	0.054	0.039	0.071	0.044	0.051	0.036
M + 2 S.D.	BS	BS		BS	BS	BS	BS	
	LH		LH		LH	LH		LH
			LF		LF	LF		LF
		GL		GL				
		FF		FF				
				BL			BL	
			AB					
		NV						
			UD					
								UF
			BR					BR
				GR				
M + S.D.								
	BL	BL			BL	BL		
		BR		BR	BR	BR		
	GL		GL		GL	GL		
	GR				GR	GR		GR
	AB				AB	AB		AB
	UH				UH	UH	UH	UH
	UF					UF		
	UD				UD		UD	UD
		HF		HF			HF	
			AX		AX			AX
				BT				
			BS					BS
	FH						FH	
	LF							
							NL	
								FF
M								
	BT	BT	BT			BT	BT	
		CH	CH	CH	CH			
	FF		FF		FF	FF	FF	
	HF		HF		HF	HF		HF
	SH		SH	SH	SH	SH		SH
	AX	AX				AX	AX	
		GR	GR	GR				
	ND	ND		ND			ND	
			NV	NV		NV		NV
				UD		UD		
			UF	UF			UF	
			UH	UH				
	NL			NL				NL
			FH	FH				NH
		AB		AB			AB	
	BR						BR	
			BL					
								GL
M - S.D.								
		NL	NL		ML	NL		
			ND		ND	ND		ND
		FH			FH	FH		
	CH					CH		CH
				AX				
					SH			SH
					NV		NV	
		UD						
								BL
							GR	
							SH	
M - 2 S.D.								

Table 45

TABLE XLVI

DISTRIBUTION OF THE DIFFERENT BODY REGIONS ACCORDING TO THE AREA OF SECRETING SURFACE OF 'SWEAT' GLANDS PER SQ.CM. OF SKIN (sq.cm.)

	AGE							
	3 - 4 YEARS					9 years 8 days		
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf II
Mean (M)	4.76	4.40	3.53	3.12	4.02	3.94	3.67	14.81
Standard Deviation (SD)	1.59	1.08	.86	.891	1.11	.746	.775	4.68
M + 2 S.D.	AX		AX			AX		
			UH		UH	UH		
		FF		FF				FF
	GR				GR			
			NL	NL			NL	
	NV					NV		
			SH		SH			
			AB					AB
					BR			BR
							ND	
	UF						UF	
M + S.D.	BT	BT		BT	BT	BT		
	AB	AB			AB	AB		
		BR	BR	BR		BR	BR	
		CH	CH	CH	CH			
		AX		AX	AX			
		NV	NV	NV			NV	NV
			UF		UF	UF		
		BL			BL		BL	
	FF					FF	FF	
		GR				GR		GR
		HF			HF			HF
				SH		SH	SH	SH
	UH			UH			UH	
			ND					
						NL		NL
	UD							
								BS
								GL
M	ND	ND		ND	ND	ND		ND
	GL	GL		GL	GL			
	HF		HF	HF		HF	HF	
	BL			BL		BL		BL
	FH		FH	FH				FH
	NL	NL			NL			
			FF		FF			
			GR	GR			GR	
			LF		LF			
			UD			UD		
				AB			AB	
		BS						
			BT				BT	BT
	BR							
						OH		OH
					LH			LH
					NV			
	SH							
							AX	
M - S.D.	BS		BS	BS	BS	BS	BS	
		FH			FH	FH	FH	
	LH		LH			LH		
		UD		UD	UD		UD	UD
			GL			GL		
						LF		LF
	LF							
			BL					
	CH							
				UF				
								AX
								UH
M - 2 S.D.								

Table 46

TABLE XLVII

DISTRIBUTION OF THE DIFFERENT BODY REGIONS ACCORDING TO THE CIRCUMFERENCE OF CAPILLARY LOOPS AT THE SUB-EPIDERMAL LEVEL OF SKIN (mm.)

	AGE							
	3 - 4 YEARS						9 years	8 days
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf II
Mean (M)	0.76	0.72	0.85	0.86	0.87	0.824	0.915	0.409
Standard Deviation (SD)	0.14	0.10	0.14	0.14	0.13	0.121	0.143	0.054
M + 2 S.D.	BS	BS	BS	BS	BS	BS		
		GL	GL	GL	GL	GL		GL
	LH		LH		LH	LH		LH
			LF		LF	LF		LF
		UD	UD	UD				
		FH					FH	
				BL				
				UF				
							AB	
M + S.D.		BL	BL		BL	BL	BL	
		HF	HF	HF		HF	HF	
			FH		FH	FH		
					UD	UD		
	UF					UF		UF
	GL						GL	
	NL						NL	
			UH					UH
	LF							
				AB				
							GR	
							BR	
							CH	
							BT	BT
							BS	
								FF
							LH	
							AX	
M	ND	ND	ND	ND	ND	ND		
	NV	NV	NV	NV	NV	NV		
	GR	GR	GR	GR	GR		GR	
	BR	BR	BR	BR	BR		BR	
	CH	CH	CH	CH	CH			
	FF	FF	FF	FF	FF			
	AB	AB		AB	AB		AB	
	UH			UH	UH	UH		
		NL	NL	NL	NL			
		BT	BT	BT	BT			
	FH		FH				FH	
	HF			HF			HF	
	UD					UD	UD	
				UF		UF		
	BL						BL	
							BS	
	AX							
			SH					
M - S.D.	SH		CH	SH	SH	SH	SH	SH
		AX		AX	AX	AX	AX	
			CH					CH
			NV					NV
	BT							
				UH				
							FF	
							LF	
								ND
								NL
M - 2 S.D.								

Table 47

TABLE XLVIII

DISTRIBUTION OF THE DIFFERENT BODY REGIONS ACCORDING TO THE DIAMETER OF CAPILLARIES AT THE SUB-EPIDERMAL LEVEL OF SKIN (m.m.)

	AGE							
	3 - 4 YEARS						9 years 8 days	
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf II
Mean (M)	.043	.045	.053	.041	.050	.046	.047	.032
Standard Deviation (S.D)	.004	.004	.013	.008	.005	.004	.005	.003
M + 2 S.D.			UD	UD		UD	UD	
	BS	BS				BS		
		HF		HF			HF	HF
			BR			BR		
					GL	GL	GL	
			LH					LH
			AB					
					AX		AX	AX
							CH	
	FH							
	ND							
		NV						
M + S.D.								
	BL		BL	BL	BL	BL	BL	BL
	AB	AB			AB	AB		AB
		BT	BT	BT		BT		
	GL	GL	GL	GL				
			BS	BS	BS		BS	
	HF		HF			HF		
	NL	NL		NL				
				NV	NV	NV		
	UF		UF			UF		UF
				BR	BR		BR	
				FF	FF			FF
			LF			LF		LF
				SH	SH			
	UD				UD			UD
			UH			UH	UH	UH
				CH				
					FH		FH	
	GR						GR	GR
					LH			
				ND				ND
M								
	CH	CH			CH	CH		CH
			AX	AX		AX		
		ND			ND	ND	ND	
	SH	SH				SH	SH	SH
	UH			UH	UH			
	BT				BT		BT	BT
	NV		NV				NV	NV
			FF			FF	FF	
				FH		FH		FH
		GR	GR					
	LF				LF			
				UF	UF			
				AB			AB	
					HF			
	LH						LH	
						NL	NL	
		UD						
								BS
								BR
								GL
M - S.D.								
	FH	FH	FH					
				GR	GR	GR		
	AX	AX						
	BR	BR						
			NL		NL			NL
		BL						
			CH					
		FF						
							LF	
			ND					
			SH					
M - 2 S.D.								

Table 48

TABLE XLIX

DISTRIBUTION OF THE DIFFERENT BODY REGIONS ACCORDING TO THE AREA OF CAPILLARY SURFACE PER SQ. CM. OF SKIN SURFACE AT THE SUB-EPIDERMAL LEVEL (sq.cm.)

	AGE							
	3 - 4 YEARS						9 years 8 days	
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf II
Mean (M.)	1.04	1.26	1.12	0.89	1.08	1.07	0.88	2.11
Standard Deviation (SD)	0.29	0.15	0.26	0.19	0.20	0.14	0.20	0.67
M + 2 S.D.	NV			NV	NV	NV		
	UF		UF			UF		
		BR			BR		BR	
			UH			UH		
					BT			
		FF						FF
				NL			NL	
					SH			
		HF						HF
							CH	
							HD	
	GR							
M + S.D.								
	AX	AX	AX	AX		AX		
		BT	BT	BT		BT		BT
		GR	GR	GR		GR	GR	GR
	NL		NL		NL	NL		
			BR	BR		BR		
				FF	FF	FF		
	UD	UD	UD					
			AB		AB		AB	AB
	ND				ND			ND
		NV	NV				NV	NV
			HF		HF	HF	HF	
				CH	CH			
					GL		GL	GL
				SH				
					UH			
		BL						BL
M								
	BL		BL	BL	BL	BL	BL	
	AB	AB		AB		AB		
	CH	CH	CH			CH		CH
	FH		FH	FH	FH		FH	FH
	GL			GL		GL		
		HD		ND		ND		
	SH		SH			SH	SH	SH
	HF			HF				
			LH		LH			LH
					UD	UD	UD	
	UH			UH			UH	
		BS	BS					BS
	BT						BT	
	BR							BR
	FF						FF	
			LF					
		NL						NL
							UF	UF
					AX			
M - S.D.								
	BS			BS	BS	BS	BS	
	LF				LF	LF	LF	LF
		FH				FH		
		GL	GL					
				UF	UF			
	LH				—	LH	LH	
			FF					
							AX	AX
			ND					
				UD				UD
								UH
						GR		
M - 2 S.D.								

Table 49

TABLE L

DISTRIBUTION OF THE DIFFERENT BODY REGIONS ACCORDING TO THE THICKNESS OF SKIN (mm.)

	AGE							
	3 - 4 years						9 years	8 days
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf II
Mean (M)	4.23	4.99	4.55	5.33	5.27	4.85	4.63	1.91
Standard Deviation (S D)	.84	1.04	.71	.85	1.04	.73	.63	.41
M + 2 S.D.	HF	HF			HF	HF		HF
	LH		LH		LH	LH		
		NV	NV	NV		NV		NV
		FF		FF		FF		
					BS		BS	
							BT	
								FH
				ND				
								NL
M + S.D.								
	BL	BL		BL	BL	BL	BL	
	BT	BT		BT	BT	BT		
	BS	BS	BS			BS		
	LF		LF		LF	LF		
		NL	NL	NL		NL	NL	
	ND	ND			ND	ND	ND	ND
	GL			GL		GL		
	GR		GR	GR				
		BR			BR			
			FT		FT		FT	FT
	NV				NV		NV	
	UH		UH					
			UF	UF				
	AX							
			CH					CH
	FN							
				HF			HF	
	SH						SH	
M								
		FH		FH	FH	FH	FH	
			AX		AX	AX	AX	
			BR	BR		BR		BR
		GL	GL		GL			GL
				SH	SH	SH		
				UH	UH	UH	UH	UH
	NL				NL			
				UD	UD			UD
				BS				BS
			BT					BT
	FF							
						GR		GR
			HF					
								LF
								LH
			ND					
								AB
			BL					BL
						UF		UF
M - S.D.								
	AB	AB	AB	AB	AB	AB	AB	
	CH	CH		CH	CH	CH		
	UD	UD	UD			UD	UD	
	UF				UF			
		GR			GR		GR	
				AX				AX
							BR	
	BR							
			FH					
			SH					SH
M - 2 S.D.								

Table 50

TABLE LI

DISTRIBUTION OF THE DIFFERENT BODY REGIONS ACCORDING TO THE DEPTH OF THE 'SWEAT' GLANDS (mm.)

	AGE							
	3 - 4 YEARS						9 years 8 days	
	Cow II	Cow III	Cow IV	Cow V	Cow VI	Average	Cow I	Calf II
Mean (M.)	1.280	1.400	1.310	1.500	1.580	1.360	1.230	0.800
Standard Deviation (SD)	0.250	0.246	0.335	0.235	0.241	0.178	0.221	0.211
M + 2SD.	FH		FH		FH	FH	FH	FH
		NV	NV	NV		NV		
	UH		UH		UH			
			UF	UF				
			LF		LF			
			LH		LH			
				ND		ND		
		BS						
							BT	
								FF
M + S.D.		BL		BL	BL	BL		BL
			BS		BS	BS	BS	
		BT	BT			BT		
		CH		CH		CH		
	GR		GR			GR		
	ND	ND			ND		ND	
			BR	BR				BR
	GL	GL						
				LF		LF		LF
	LH					LH		
				UD				UD
	UF							UF
								AB
	AX						AX	
		FF						
				FH				
								NF
		NL						
					NV			
				SH				
							UH	
M								
	AB	AB	AB		AB	AB	AB	
	NL		NL	NL	NL	NL	NL	NL
	FF		FF	FF		FF	FF	
	HF	HF			HF	HF		
	UD	UD			UD	UD	UD	
			AX	AX	AX			
	BT		BS	BT	BT			BT
		BR			BR	BR	BR	
	CH		CH		CH			CH
		GR		GR	GR		GR	GR
	SH				SH	SH	SH	SH
	BL		BL				BL	
					GL	GL		GL
					UF	UF		
	BS							BS
		FH						
								LH
			ND					ND
	NV						NV	NV
						UH		UH
M - S.D.			GL	GL				
			HF	HF			HF	
				AB				
						AX		AX
				BS				
	BR							
					FF			
	LF							
				LH				
			SH					
			UD					
				UH				
M - 2 S.D.								

TABLE LII

THE NUMBER OF HAIRS PER SQ. CM. OF SKIN SURFACE OF ZEBU, FORMOSIAN, HOLLÄNDER AND AYRSHIRE CATTLE COMPARED

Breed	* Sind Zebu	Sind Zebu	Kankrej Zebu	Formosian	Formosian	Holländer	† Ayrshire	Ayrshire
Sex	Cow	Bull	Bull	Cow	Bull	Bull	Average of 5 cows	Cow I
Age	15 yrs.	10 yrs.	13 yrs.	7 yrs.	15 yrs.	5½ yrs.	3 - 4 yrs.	9 yrs.
Forehead	1851	776	1426	2100	1063	900	1598	903
Neck (dorsal)	2278	-	1722	2200	1038	840	2166	1827
Neck (lateral)	3056	1200	2389	2513	1400	1060	2398	1776
Back (thoracic)	1600	1450	1907	1450	975	870	2255	1101
Back (lumbar)	1205	1200	1407	1475	975	1000	1607	1087
Front Flank	1723	1800	2204	1825	1175	1120	2149	1743
Shoulder	2315	2109	2403	2938	1238	1110	2236	1821
Gluteus	1503	2475	1519	2075	1150	1320	1292	1165
Breast	1167	2250	2389	2900	1225	1450	2109	1421
Abdomen	1550	1750	1519	1763	1150	1030	1871	1327
Udder	1775	1115	1148	1800	650	570	1462	969
Axilla	944	1900	2852	2138	1488	1360	2444	1117
Upper Foreleg	2574	1625	2407	2263	1125	1040	1937	1658
Lower Foreleg	1705	1622	2019	1463	1038	1290	1000	1291
Upper Hind-leg	1725	1325	2056	2075	1400	1356	2218	1261
Lower Hind-leg	1250	1175	1889	1550	1013	810	882	931
Total	26626	23772	31256	32528	18043	17126	29624	21398
Mean	1644	1486	1953	2033	1128	1070	1852	1337
Standard deviation	557	471	471	468	202	241	490	330

* Yamane and Ono's data.

† The Author's data.